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NATIONAL DAM SAFETY PROGRAM. SWAN LAKE DAM (INVENTORY NUMBER NY--ETC(U)
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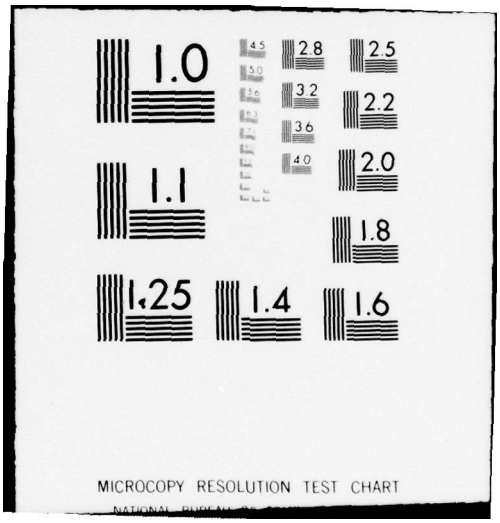
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REPORT DOCUMENTATION PAGE

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

Swan Lake Dam was found to have no conditions which constitute an immediate threat to life or property. However, a number of deficiencies were found which require immediate attention.

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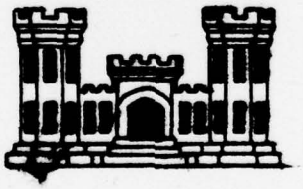
DELAWARE RIVER BASIN

SWAN LAKE DAM

SULLIVAN COUNTY, NEW YORK

INVENTORY NO. N.Y. 333

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



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NEW YORK DISTRICT CORPS OF ENGINEERS

MARCH, 1979

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probably Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SWAN LAKE DAM I.D. No. NY 333
DEC #279 DELAWARE RIVER BASIN
SULLIVAN COUNTY

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PHASE 1 REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Swan Lake Dam (I.D. No. NY 333)
State Located:	New York
County Located:	Sullivan
Stream:	West Branch of the Mongaup River (tributary of Delaware River)
Dates of Inspection:	October 19, 1978 February 27, 1979

[cont'd from p. 1]

ASSESSMENT

The examination of the documents and visual inspection of Swan Lake Dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to life or property. The dam however, has a number of deficiencies which if not remedied may have the potential for developing into hazardous conditions. The following deficiencies are:

1. The spillway capacity is severely limited; 0.7% of the Probable Maximum Flood (PMF) with stop logs and 5% of the PMF without stop logs. To increase spillway capacity and prevent the development of hazardous conditions, the abandoned spillway bridge and suspended utility lines must be removed within 1 year of notification.

2. The spillway stop logs should be replaced with collapsable flashboards which fail at a specific reservoir level. This should be accomplished within 1 year of notification.

3. Erosion at the base of the metal bin wall of the abandoned bridge approach near the southeast corner of the spillway must be repaired immediately to prevent failure of the approach embankment.

4. Cracking and deterioration of the spillway slab and walls must be repaired within 1 year of notification.

5. The existing reservoir drain is plugged. An investigation is required to determine of this drain can be returned to operating condition or a new reservoir drain is required. This investigation should be completed within 1 year of notification and a working reservoir drain installed within the following year.

6. At bi-monthly intervals, monitor the bulge on the downstream masonry face in the vicinity of the penstock and the seepage from the penstock and the reservoir drain.

The discharge capacity of the spillway is inadequate for all flow in excess of 0.7% of the PMF (spillway capacity = 130 cfs) with stoplogs and 5% of the PMF (spillway capacity = 950 cfs) without stoplogs. The spillway is not considered seriously inadequate, based on the Corps of Engineer's Screening Criteria, since the hydrologic/ hydraulic analysis indicats that a failure of the dam would not significantly increase the flooding potential downstream over that which would occur before a failure. Since the spillway capacity is severely limited, items 1 and 2 listed above must be undertaken to insure the safety of the structure and limit flooding of the adjacent upstream bridge and highways. Until such measures are undertaken, continuous monitoring of the structure must be initiated during periods of high run-off and a contingency plan adopted to inform the proper authorities in the event of overtopping.

George Koch

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Approved By:

Clark H. Benn

Col. Clark H. Benn
New York District Engineer

Date:

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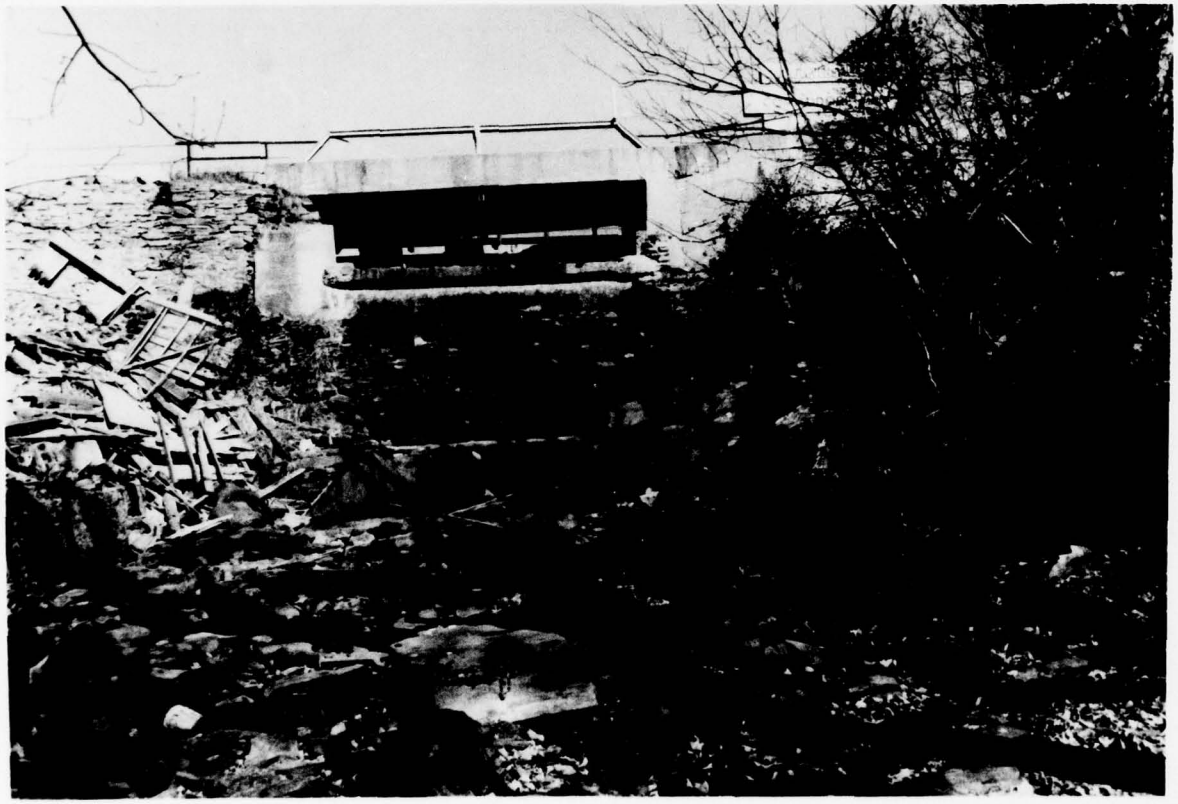
OVERVIEW OF SWAN LAKE DAM

Photo #1



SWAN LAKE DAM
DOWNSTREAM FACE

Photo #2

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SWAN LAKE DAM I.D. No. NY 333
DEC #279 DELAWARE RIVER BASIN
SULLIVAN COUNTY

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase 1 inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers, to fulfill the requirements of the National Dam Inspection Act, Public Law 92-367.

b. Purpose of Inspection

Evaluation of the existing conditions of the subject dam to identify deficiencies and hazardous conditions, determine if they constitute hazards to life and property and recommend remedial measures where necessary.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenant Structures

The Swan Lake Dam was constructed in 1894 and consists of a 112 feet long earth embankment with rockfill core and a 23 feet wide drop spillway located on the eastern side of the embankment. The dam is 31 feet high. There is a bridge over the spillway channel and a mill immediately downstream of the dam. The bridge was abandoned after completion of a new road and bridge located 39 feet upstream of the dam. The mill has also been abandoned and only the foundation and parts of the walls remain. The 3.5 feet diameter steel pipe (Penstock) which supplied water to the mill is plugged.

The upstream side of the embankment was filled to accommodate a highway, gas station and other facilities such that the top width of the embankment is now over 100 feet. The upstream slope of the embankment is approximately 1 vertical to 2 horizontal. The downstream slope is nearly vertical and is protected by a stone masonry face wall.

The lake level was raised 4 feet by the installation of stoplogs and concrete support piers which are located at the upstream face of the spillway. This installation has drastically reduced the spillway capacity. (See sketch in Appendix C - page 7). The 3½ feet diameter steel pipe reservoir drain is not operational.

[Cont'd on p. iv]

b. Location

Swan Lake Dam is located on West Branch of Mongaup River, a tributary of the Delaware River. The dam is situated in the Town of Liberty, Sullivan County.

c. Size Classification

The dam is classified as "intermediate" size, due to the storage capacity (1000 to 50,000 acre-feet).

d. Hazard Classification

The dam is classified as "high" hazard because the Villages of Swan Lake and Bethel lie immediately downstream of the dam.

e. Ownership

The dam is jointly owned by Mr. A. Lowenthal, Mr. Edward Brinn and Mrs. Sylvia Brinn. The dam is operated by Mr. Edward Brinn, Box 267, Swan Lake, NY 12783; Telephone (914) 292-4567.

f. Purpose of the Dam

The dam was originally constructed to provide recreational facilities and power generation for the mill at the base of the dam. The mill is now abandoned and the dam is currently used solely for recreational purposes.

g. Design and Construction History

The original dam constructed in 1894 was reconstructed sometime between 1894 and 1919. A 20 feet wide bridge placed over the spillway section connected the Sullivan County Route 142 to the New York State Route 55. This bridge was abandoned after completion of a new bridge constructed about 1962, approximately 39 feet upstream of the dam. According to Mr. Edward Brinn, the piers and stoplogs at the upstream edge of the spillway, have been in place since the beginning of this century and the spillway section was last reconstructed in 1962.

h. Normal Operating Procedures

Water releases from the Swan Lake pass over the 4 feet high stoplogs to the spillway apron and from the apron, water falls approximately 15 feet to the natural stream bed. The owner removes one or more stoplogs during heavy rainfall and runoff in order to prevent flooding of the adjacent areas. All stoplogs are removed during the fall and winter for maintenance and flood protection purposes.

1.3 PERTINENT DATA

a. Drainage Area (sq. mi.)	14.54
b. Discharge at Dam Site (cfs)	
Maximum known flood	Unknown
Spillway at maximum pool	950
Spillway at maximum pool with 4 feet flashboards	130
Maximum capacity of reservoir drain	0
Total discharge, max. pool, El. 1333.0	950
Total discharge, max. pool, with 4 feet flashboards	130
c. Elevation (feet above MSL - Datum)	
Top of dam	1,333.0
Top of flashboards	1,330.0
Top of spillway	1,326.0
Tailrace channel	1,302.0

d. Reservoir (at spillway crest)

Length of maximum pool, miles	2.84
Length of shoreline, miles	6.82
Surface area, acres	327

e. Storage (acre-feet)

Spillway crest	2,170
Top of flashboards	3,070
Top of dam	3,760

f. Dam

Embankment type:	Earth with rock fill core	
Height, feet		31
Length, feet		112
Upstream slope:	1:	2.1
Downstream slope:	Vertical protected by stone masonry face wall	
Crest elevation, feet		1333
Crest width, feet		Over 100
Impervious core		None
Grout curtain		None

g. Spillway

Type:	Drop spillway	
Length, feet (see sketch in Appendix C, page 7)		17
Crest elevation, MSL		1326
Upstream channel:	*Not Visible*	
Downstream channel:	Rock outcrop in channel	

h. Regulating outlets — Both the penstock and the reservoir drain are inoperative.

i. Cutoff — None

SECTION 2: ENGINEERING DATA

2.1 DESIGN

a. Geology

The Swan Lake Dam is located in the "Appalachian Uplands" physiographic province of New York State. This province (the northern extreme of the Appalachian Plateau) was formed by dissection of the uplifted but flat lying sandstones and shales of the Middle and Upper Devonian Catskill Delta. Relief is high to moderate. Maximum dissection occurs in the Catskill Mountain area, where only the mountain peaks approximate the original plateau surface. Drainage is generally southwest toward the Delaware River system.

b. Subsurface Investigations

No subsurface investigation could be located for this dam. However, the "Dam Report" filed by Mr. Edwin Krauss (see Appendix F) states that the dam is founded on rock and loam.

The "General Soil Map of New York State" prepared by Cornell University Agriculture Experiment Station indicates that the surficial soils are of the Lackawanna series, of glacial till origin. This series is generally stony silt sand and gravel with a trace of clay, having poor internal drainage characteristics. Boulders are common, and depth to bedrock is variable. Sandstone bedrock was observed to outcrop in the downstream channel.

c. Dam and Appurtenant Structures

The dam was reported to be constructed about 1894 (see "Dam Report" filed by Mr. Edwin Krauss - Appendix F). No other information could be located concerning the design or construction of the dam.

2.2 CONSTRUCTION RECORDS

No construction records are available.

2.3 OPERATION RECORDS

No maintenance and operation record or manual is available.

2.4 EVALUATION OF DATA

The data available is extremely limited. The information reported herein is based on NYS Department of Environmental Conservation files, discussions with Silvia and Edward Brinn (owners of the dam) who aided greatly, and the visual inspection.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General

The visual inspection of Swan Lake Dam and the surrounding watershed was conducted on October 19, 1978 and February 27, 1979. The weather was cloudy and the temperature ranged in the forties. The lake level was 4.0 feet above spillway crest at the time of inspection due to the presence of stoplogs.

b. Embankment

Development of the gas station facilities and the highway prohibited the detailed inspection of the western portions of the crest and the upstream face. Inspection of the remaining portions indicate that the crest and slopes of the embankment are in good condition. No seepage was evident at the toe or on the slopes. Seepage was evident in the vicinity of the penstock and the reservoir drain, which are both inoperative and abandoned (see photographs #2 & #10). The 42" penstock located on the west side of the spillway exhibited seepage at a rate of approximately 5 gallons per minute. This flow appeared to be related to incomplete plugging of the pipe. The 42 inch reservoir drain located under the spillway is plugged with concrete. Seepage from this drain is estimated to be between 5 and 7 gallons per minute. Flow thru the pipe could be related to an incomplete plug, or spillway flow either thru the deteriorated spillway slab or thru the end of the drain pipe which projects past the edge of the spillway and is deteriorated on its upper surface. A void was also observed adjacent to the drain in the masonry portion. This void is approximately 8 inches by 2 feet and extends to a depth of about 3 feet. A detailed inspection could not be accomplished due to spillway flow. However, the problem did not appear to be significant and new masonry could easily be placed to repair this void.

Slight bulging was observed in the stone masonry on either side of the penstock for a total distance of approximately 16 feet. No recent movement was observed in this 2 to 3 inch bulge. This bulge may have been the result of mis-alignment during construction.

A metal bin wall contains the bridge approach embankment at the southeast corner of the spillway. Considerable erosion at the base of the bin wall (caused by steep slopes and excess highway drainage) has reduced the support for the wall and the wall has bowed outward. This problem, if unchecked, will lead to failure of the bridge approach embankment.

No other seepage, depressions or ground movement was observed. No instrumentation is present at the dam. No problems were observed related to reservoir slopes or sedimentation.

c. Spillway

The concrete spillway is constructed on the embankment with an abandoned highway bridge spanning the entire spillway. Three groups of 4 feet wide stoplogs control the lake elevation. Previous modifications to the spillway have reduced the spillway area to 79 square feet (see photographs #7, 8 & 18). Utility lines which are suspended beneath the abandoned bridge slab further reduce the spillway capacity. The spillway walls and slab are cracked and deteriorated, particularly the spillway walls (see photographs #3 & 4). The spillway slab has deteriorated in the vicinity of the area excavated for another utility line. A void approximately 10 inches in diameter was observed near the east abutment, where the concrete patch over the utility line was dislodged, and spillway flow was observed entering this void.

d. Regulating Outlets

The 42 inch diameter penstock and the 42 inch diameter reservoir drain have been plugged and are inoperative. No other regulating outlets are present.

e. Downstream Channel

The downstream channel is the natural channel of the west branch of the Mongaup River (see photographs #11 & 12). The channel bottom is exposed bedrock. The channel is littered with stones, boulders and some limited debris. Some trees were also observed in the channel. The side slopes of the channel are rock outcrops or bedrock controlled slopes and appear stable. The dam lies between 2 bridges (see photographs #13 & 16). The upstream bridge is 39 feet from the dam and the downstream bridge is approximately 3000 feet from the dam. Both of these bridges, in addition to the dam, will act as control points.

f. Spillway Bridge

The abandoned spillway bridge which covers the entire spillway is reducing the spillway flow (see photographs #1, 2 & 14). In addition, the bridge slab is cracked and deteriorated. The slab exhibits signs of calcification and appears to have contracted relative to the abutment walls which form the walls of the spillway. The limited spillway capacity and the deteriorated condition of this bridge may necessitate its removal.

3.2 EVALUATION OF OBSERVATIONS

Although deficiencies were observed, there are no indications that the dam is in imminent danger. Most deficiencies are minor and may be corrected by maintenance forces.

SECTION 4: OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

The Swan Lake Dam was previously used to operate a mill and provide recreational facilities. The mill has since been abandoned and the lake is currently used for recreational purposes only. The lake level is normally kept 4 feet above the spillway crest by the use of stoplogs. Some of the stoplogs are removed during heavy flows.

4.2 MAINTENANCE OF THE DAM

There is no regular program of repair and maintenance and no operation and maintenance manual is available.

4.3 MAINTENANCE OF OPERATING FACILITIES

The penstock and the reservoir drain are inoperative.

4.4 WARNING SYSTEM IN EFFECT

There is no warning system in effect or in preparation.

4.5 EVALUATION

The maintenance of the Swan Lake Dam is considered inadequate in the following areas:

a. Disrepair of the reservoir drain and areas around the penstock.

b. Deterioration of spillway slab and abutment walls.

c. Control of erosion at the base of the metal bin wall near the spillway.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 DRAINAGE AREA CHARACTERISTICS

The Swan Lake Dam is located on the west branch of the Mongaup River, a tributary of the Delaware River. The drainage area at the dam is 14.54 square miles. The topography is characterized by gentle slopes interspersed with swamps.

5.2 ANALYSIS CRITERIA

It was determined that the new bridge will act as a controlling point before the water reaches the dam. The road on the bridge is 3 feet higher than the top of the dam. Hence, this bridge was analyzed like a spillway and the dam downstream was analyzed as a channel with a critical section. A second bridge downstream of the dam was also analyzed as a critical section of the channel.

Other analyses were performed to determine the capacity of the bridge to pass the flood through the development of Probable Maximum Flood (PMF) for the watershed and the subsequent routing of the PMF through the reservoir using HEC 1-DB.

The unit hydrograph was defined by the Snyder Coefficients, Tp and Cp. The Probable Maximum Precipitation (PMP) was 21.0 inches (Figure 1), Hydrometerological Report (HMR #33) for a 24 hour duration, 200 square mile basin. The percentages of the PMP applied to other duration storms were interpolated from the plot of drainage area versus percent of the 24 hour, 200 square mile depth (Figure 2, HMR #33). The PMF inflow hydrograph was determined by applying the PMP to the unit hydrograph for the basin and the peak inflow was 17,800 cfs. After routing the peak inflow through the impounded storage, the peak outflow was determined to be 17,600 cfs. Half of PMF peak inflow was 8,900 cfs and the routed peak outflow was 8,600 cfs.

5.3 SPILLWAY CAPACITY

The maximum possible head between the crest of the spillway and bottom of the bridge slab has been reduced from 5.75 feet to 1.75 feet by using 6 - 8 inch high stoplogs. The maximum width possible has been reduced from 23 feet to 17 feet by the presence of the piers.

The maximum computed capacities of the spillway are as follows:

	SPILLWAY CAPACITY		
	With Stoplogs in place	Without Stoplogs	Before construction of piers and installation of stoplogs
	130 cfs	950 cfs	1300 cfs
PMF 17,600 cfs	0.74%	5.4%	7.4%
1/2 PMF 8,600 cfs	1.5%	11.0%	15.1%

5.4 RESERVOIR CAPACITY

The reservoir capacity is given below:

	El. (feet)	Capacity (acre-feet)
Crest of Spillway	1326	2168
Top of stoplogs	1330	3070
Top of dam	1333	3758
Top of bridge (upstream)	1336	4451

The storage capacity curve is shown in Appendix D. The curve indicates a surcharge storage of 1381 acre-feet above the stoplogs, and is equivalent to a runoff depth of 1.8 inches over the drainage area.

5.5 FLOODS OF RECORD

There is no record of highest or lowest water levels at the dam site.

5.6 OVERTOPPING POTENTIAL

The HEC-1-DB analysis indicates that the bridge, the dam and the downstream bridge will be overtopped as follows:

	OVERTOPPING IN FEET		
	Bridge	Dam	Downstream Bridge
1/2 PMF	1.59	2.9	3.4
PMF	2.82	4.8	5.2

A number of homes on both sides of Route #155 near the downstream bridge will be affected by basement flooding from both the PMF and 1/2 PMF. Should a failure of the dam occur, the failure will be limited to the spillway section since the embankment is not constructed of erodable material, the embankment width and surface development (paving etc..) is not as susceptible to erosion, the upstream bridge and its approach embankments are protected by sheet piling and the downstream face of the dam is protected by masonry construction.

5.7 EVALUATION

The limited spillway capacity and reservoir storage will result in overtopping of the dam during the 1/2 PMF event and subsequent flooding downstream. However, based on the Corps of Engineers Screening Criteria, it is not considered seriously inadequate, since failure of the dam will not significantly increase the flooding potential downstream over that which would occur before failure. Since the limited spillway capacity is a result of the abandoned spillway bridge and the stoplog and concrete pier system, removal of these obstructions will dramatically increase the spillway discharge capacity. These recommendations are contained within this report. In the interim, continuous monitoring of the structure during periods of high run-off must be initiated and a contingency plan adopted in the event of overtopping.

SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

The visual observations did not indicate any sign of major distress in connection with the dam. Minor seepage was evident from the plugged regulating outlets. Slight bulging (2 to 3 inches) was observed on the downstream stone masonry face in the vicinity of the penstock. This bulging does not appear to be active. Erosion was evident at the base of a metal bin wall near the southeast corner of the spillway, which resulted in a bowing out of the bin wall. Spillway capacity is being dramatically reduced by the presence of the abandoned bridge and the utility lines which traverse beneath the bridge slab. The abandoned spillway bridge is cracked and deteriorated. The reservoir drain is inoperative. These deficiencies are not yet considered to be adversely affecting the structural stability of the structure.

b. Design and Construction Data

No design computations or other data regarding the structural stability of the dam are available.

c. Operating Records

No records of operation are available and no major operational problems were reported.

d. Post Construction Changes

The spillway was modified in 1962 by placing concrete columns and stoplogs along the upstream edge of the spillway. During 1963 and 1964, the spillway bridge was abandoned and a new highway embankment and bridge was constructed approximately 39 feet upstream from the spillway. The embankments are protected by riprap and the approaches by steel sheet piling.

e. Stability

The dam is located in seismic zone 1. Therefore, a seismic analysis is not warrented.

SECTION 7: ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

The Phase 1 inspection of Swan Lake Dam did not indicate conditions which constitute an immediate hazard to human life or property. The dam is not considered to be unstable. However, conditions of deterioration in the spillway, masonry walls and abandoned spillway bridge may lead to the development of hazardous conditions. In addition, the spillway is adequate to pass only 0.7% of the PMF with stoplogs and 5% of the PMF without stoplogs.

For the aforementioned reasons, Swan Lake Dam requires certain measures and improvements to insure a safe and stable structure.

b. Adequacy of Information

The information available is adequate for Phase 1 inspection purposes. It should be noted that the design and construction information is extremely limited.

c. Urgency

Since the spillway capacity is severely limited and flooding was previously reported due to stoplog placement, the system of stoplogs and concrete at the upstream edge of the spillway should be analyzed and modifications instituted within 1 year of notification. The deteriorating spillway bridge and utility lines must be removed within 1 year of notification. Erosion at the base of the metal bin wall must be repaired immediately to prevent bridge approach embankment failure. Investigation of the plugged reservoir drain should be accomplished within 1 year of notification and an operating reservoir drain provided within the following year.

d. Need for Additional Investigation

To prevent the development of potentially hazardous conditions, investigations should be conducted in the following areas:

1. Investigate the condition of the present stoplog system and institute modifications to increase spillway capacity during peak flows.

2. Investigate the condition of the plugged reservoir drain to determine if this system can be returned to operational condition.

7.2 RECOMMENDED MEASURES

a. The abandoned spillway bridge and the utility lines suspended beneath the bridge must be removed to increase spillway capacity.

b. The spillway stoplogs should be replaced with flashboards which collapse at a specific reservoir level.

c. Erosion at the base of the metal bin wall near the southeast corner of the spillway must be repaired.

d. Cracking and deterioration of the spillway slab and walls must be repaired.

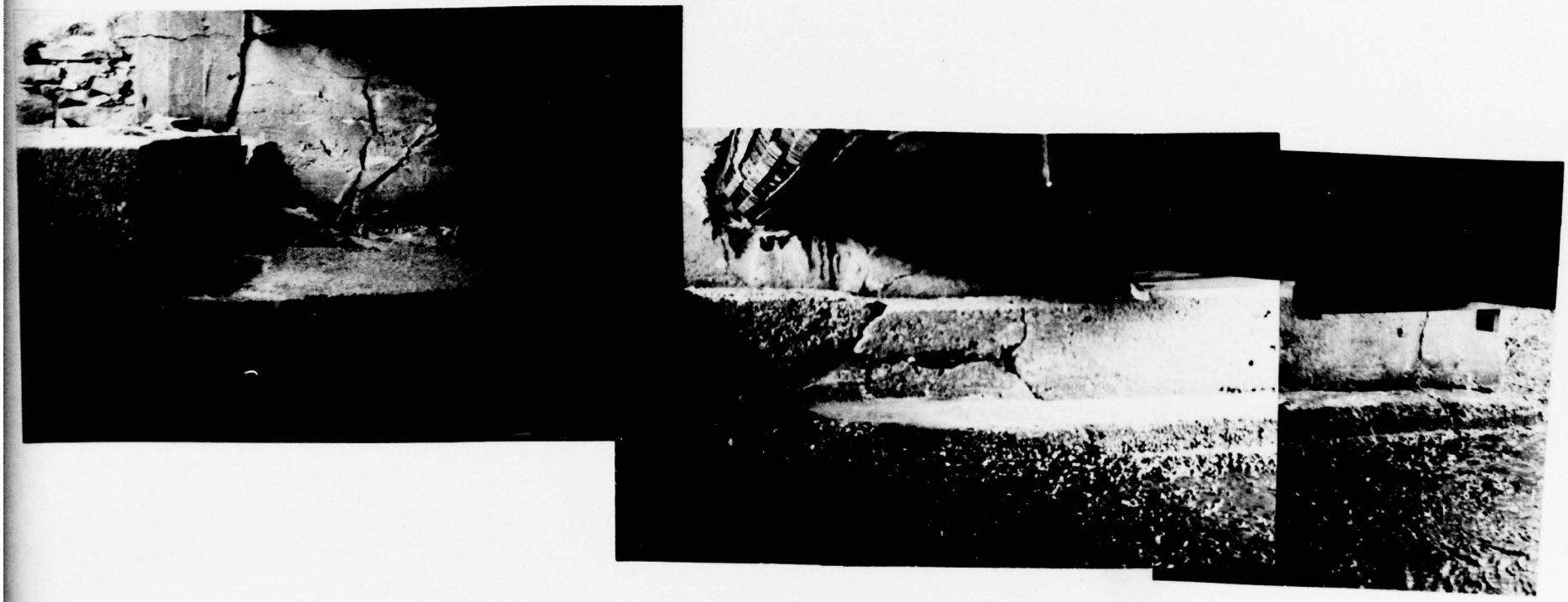
e. Periodically monitor the bulge on the downstream masonry face in the vicinity of the penstock to determine if further movement is occurring. Periodically monitor the seepage from the penstock and the reservoir drain to ascertain changes in flow.

f. Provide a reservoir drain to lower the lake level for future maintenance and repair work.

g. Initiate a program of periodic inspection and maintenance of the dam and appurtenances. Document this information for future reference. Also, develop an operations manual.

APPENDIX A

PHOTOGRAPHS



EAST ABUTMENT WALL
NOTE CRACKING & DETERIORATION

Photos #3A, B & C

WEST ABUTMENT WALL

Photos #4A, B & C

VOID IN SPILLWAY SLAB
NORTHEAST CORNER

Photo #5

WEST ABUTMENT WALL
NOTE DETERIORATED MASONRY

Photo #6

STOPLOGS

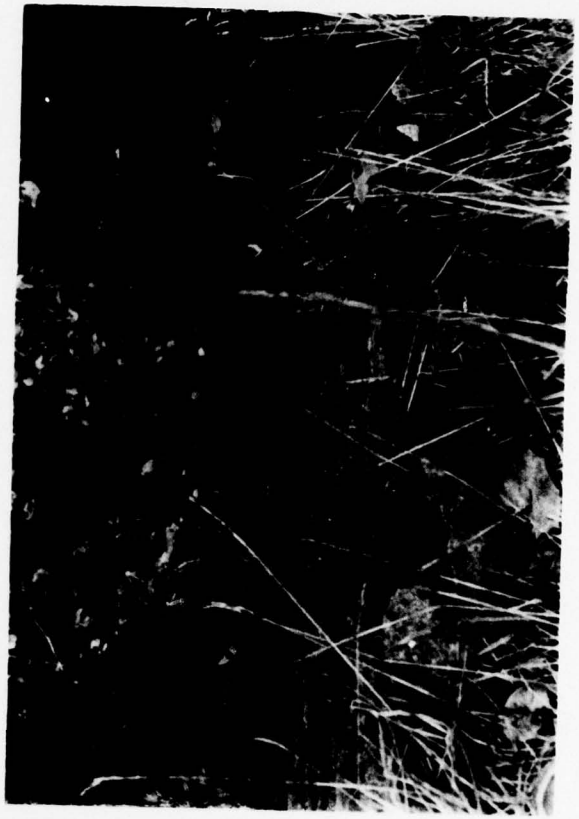
Photo #7

STOPLOGS VIEWED FROM SPILLWAY

Photo #8

PENSTOCK AS VIEWED FROM BASE OF DAM

Photo #9



PENSTOCK AS VIEWED FROM TOP OF DAM
NOTE: SLIGHT BULGE IN MASONRY

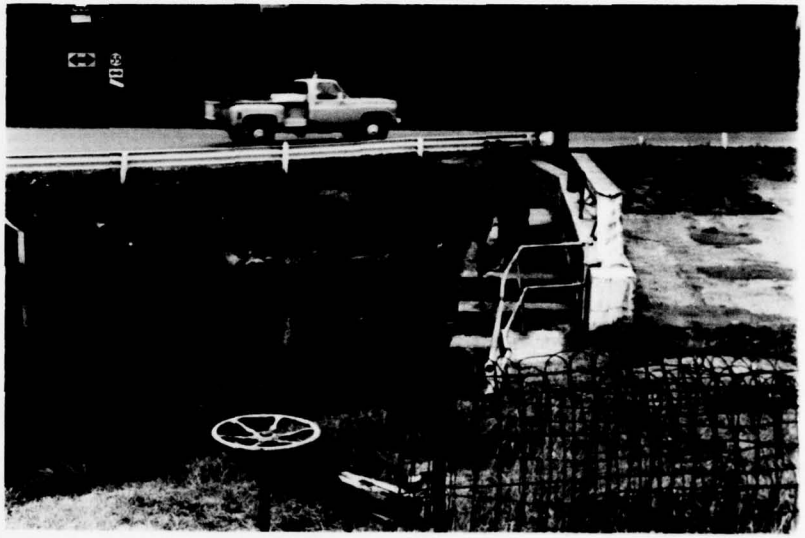
Photo #10

DOWNSTREAM CHANNEL AJDACENT TO
ABANDONED MILL

Photo #11

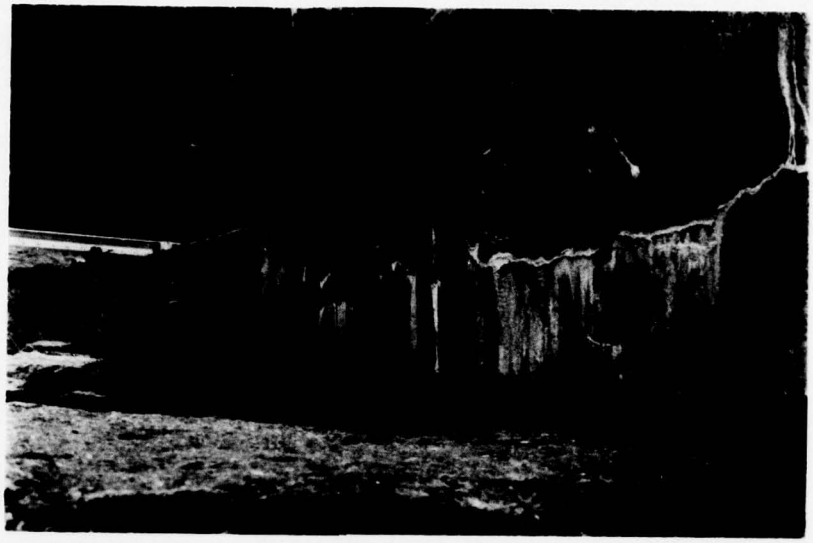
ABANDONED MILL AT BASE OF DAM

Photo #12



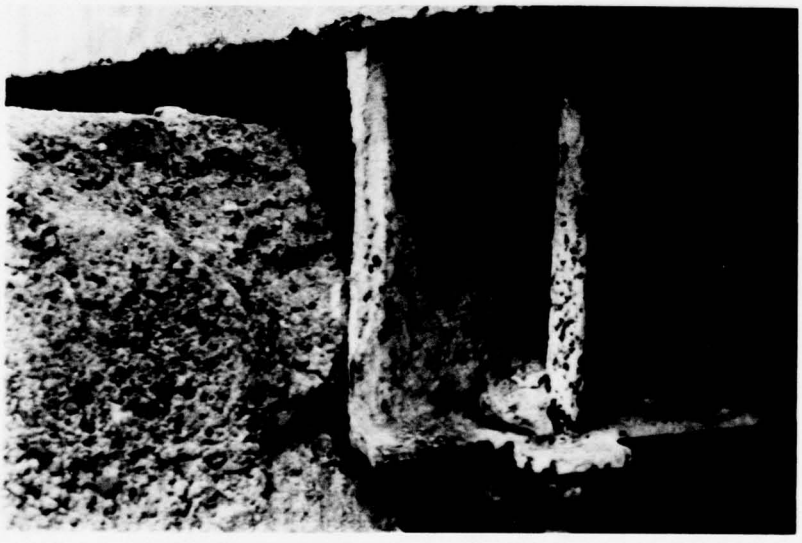
AREA BETWEEN DAM AND UPSTREAM HIGHWAY BRIDGE

Photos # 13 A & B



SPILLWAY BRIDGE DECK VIEWED FROM UPSTREAM SIDE
NOTE DETERIORATION & CALCIFICATION

Photo #14

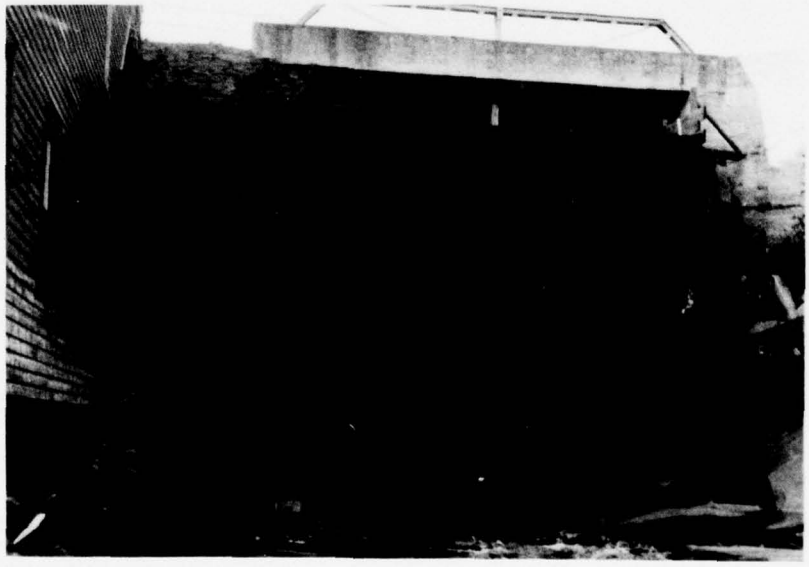


SPILLWAY BRIDGE DECK I - BEAM
NOTE DETERIORATION OF CONCRETE STOPLOG SUPPORT

Photo #15

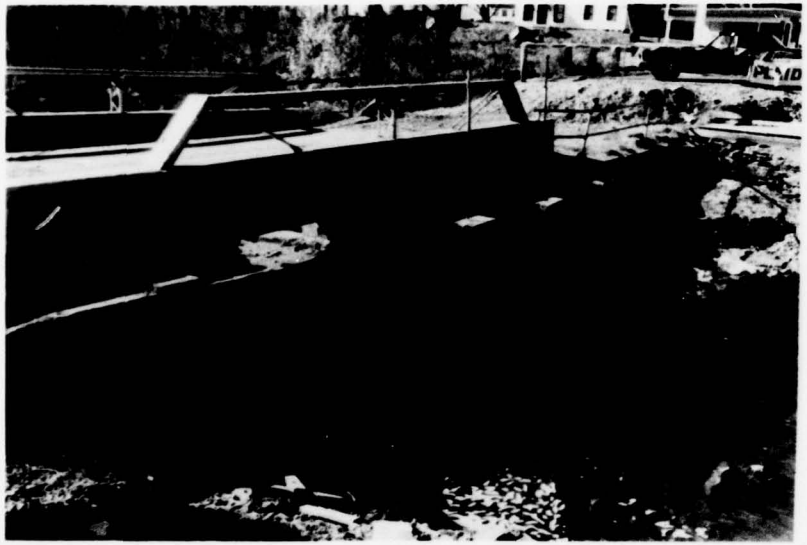
DOWNSTREAM BRIDGE AND CHANNEL

Photo #16



OLD PHOTOGRAPH OF DOWNSTREAM FACE (DATE: 1918)
NOTE: OLD MILL (NOW DESTROYED)

Photo #17

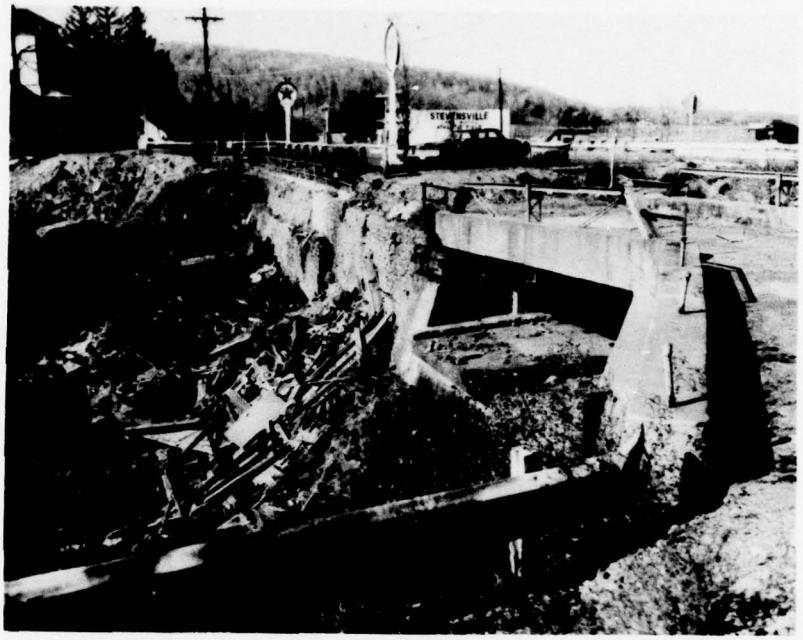


UPSTREAM FACE OF DAM AND AREA ADJACENT TO
PENSTOCK INTAKE (1962)

Photo #18

INTAKE AREA FOR PENSTOCK (1962)
NOTE: THIS AREA IS NOW FILLED IN

Photo #19



DOWNSTREAM FACE OF DAM (1962)
Looking West

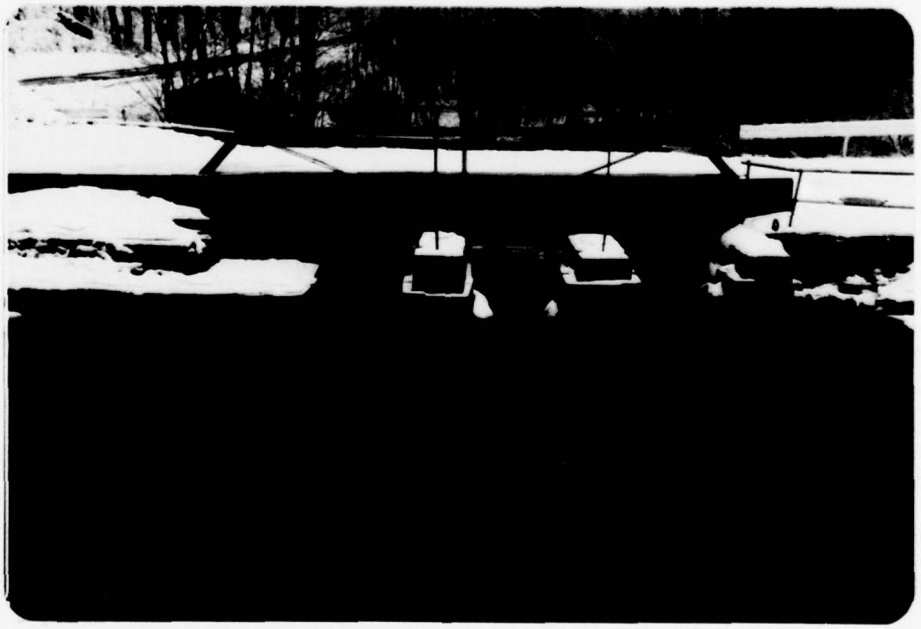


PHOTO #21

UPSTREAM FACE OF DAM - PHOTO #21

APPENDIX B

ENGINEERING DATA CHECKLIST

Check List
Engineering Data
Design Construction Operation

Name of Dam Swan Lake Dam

I.D. # N.Y. 333

Item	Remarks		
	Plans	Details	Typical Sections
Dam	None	None	None
Spillway(s)	"	"	"
Outlet(s)	"	"	"
Design Reports	None		
Design Computations	None		
Discharge Rating Curves	None		
Dam Stability	None		
Seepage Studies	None		
Subsurface and Materials Investigations	None		

Item	Remarks
Construction History	None other than reported in section 1g
Surveys, Modifications, Post-Construction Engineering Studies and Reports	None
Accidents or Failure of Dam Description, Reports	None reported other than overtopping on March 25, 1963.
Operation and Maintenance Records Operation Manual	None.

APPENDIX C

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam Swan Lake Dam

I.D. # N.Y. 333

Location: Town Liberty County Sullivan

Stream Name West Branch of the Mongaup River

Tributary of Delaware River

Longitude (W), Latitude (N) 74°-46'-9" / 41°-45'-2"

Hazard Category C

Date(s) of Inspection 10.18.78 and 2.27.79

Weather Conditions Mid 40s, cloudy / Upper 20s, light snow

b. Inspection Personnel Bob Mccarty, M. Islam, Sylvia Brinn, Edward Brinn

c. Persons Contacted Edward Brinn, Box 267, Swan Lake New York 12783 Tel: (914) 292-4567. Pete Grosso Supervisor, Town of Liberty, Tel. (914) 292-5111

d. History:

Date Constructed 1894

Owner Edward & Sylvia Brinn, A. Lowenthal

Designer Unknown

Constructed by Unknown other than original owner, Alden S. Swan

2) Technical Data

Type of Dam Earth and Masonry Dam

Drainage Area 14.5 square miles

Height 31 feet Length 135 feet

Upstream Slope Unknown Downstream Slope Vertical

2) Technical Data (Cont'd.)

External Drains: on Downstream Face None @ Downstream Toe None

Internal Components:

Impervious Core none

Drains none

Cutoff Type none

Grout Curtain none

3) Embankment

a. Crest

(1) Vertical Alignment appears good

(2) Horizontal Alignment appears good

(3) Surface Cracks none evident

(4) Miscellaneous Gasoline station has developed embankment to the west of the spillway

b. Slopes

(1) Undesirable Growth or Debris, Animal Burrows

(2) Sloughing, Subsidence or Depressions none observed

(3) Slope Protection Riprap on upstream face of new bridge protects dam embankment

(4) Surface Cracks or Movement at Toe none evident

(5) Seepage none evident some seepage around penstock & reservoir drain

(6) Condition Around Outlet Structure some deterioration of masonry around outlets, reservoir drain void: 8' x 2' 3 feet deep. slight bulge (½ to 3 inches) around masonry wall near penstock. misalignment during construction possible. no recent movement.

c. Abutments

(1) Erosion at Embankment and Abutment Contact south east corner of bridge approach - considerable erosion at wing wall and near metal bin. Erosion ≈ 4' deep has undermined and bowed out bin wall

(2) Seepage along Contact of Embankment and Abutment none evident

(3) Seepage at toe or along downstream face none evident

d. Downstream Area - below embankment

(1) Subsidence, Depressions, etc. no problems observed

(2) Seepage, unusual growth no problems observed

(3) Evidence of surface movement beyond embankment toe none evident

(4) Miscellaneous

e. Drainage System

no internal drainage system

(1) Condition of relief wells, drains, etc. n/a

(2) Discharge from Drainage System n/a

4) Instrumentation

(1) Monumentation/Surveys None

(2) Observation Wells None

(3) Weirs None

(4) Piezometers None

None

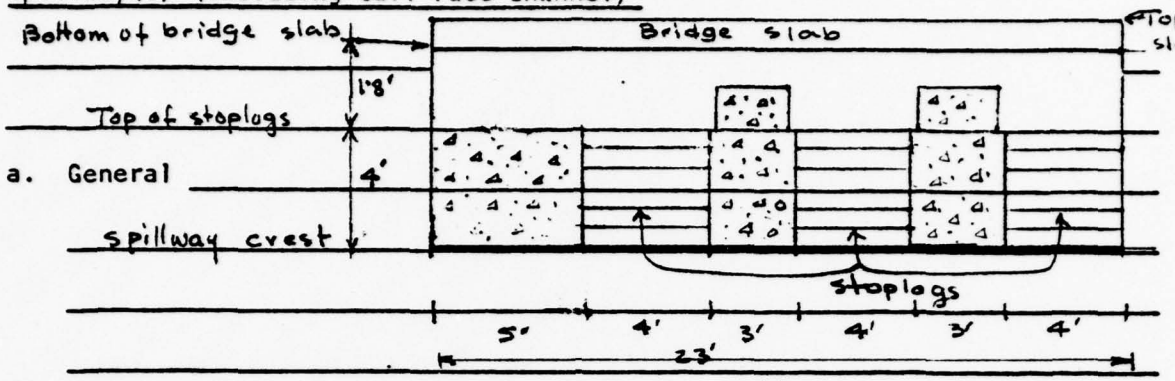
(5) Other

5) Reservoir

a. Slopes OK. No problems observed or reported.

b. Sedimentation None reported.

6) Spillway(s) (including tail race channel)



a. General

b. Principle Spillway This is a straight inlet drop spillway with stoplogs and a bridge over the top as sketched above. The bridge was abandoned and a new one built 39 feet upstream of the spillway in 1963-64. The spillway used to be 23' wide and 5.8' high with a clear opening of 133 sq. ft. The spillway was modified in 1962 as above leaving a clear opening of 79 sq. ft. Conditions under the bridge slab are as followings: The spillway floor is cracked (see picture #) and the beam is cracked and spalled (see picture #). The mortar joints of the east abutment wall deteriorated and a few stones are lost. A sewer line and a water line pass right under the bridge slab.

c. Emergency spillway ——— None.

d. Condition of Tail race channel The channel bottom is rock. The channel is littered with stones, boulders, tires, logs etc.

e. Stability of Channel side/slopes looks stable. No problem areas observed.

b. Utility Lines

The utility lines which pass beneath the bridge slab are restricting the spillway capacity. The upstream pipe is approximately 18" in diameter. The other conduit is a

7) Downstream Channel

a. Condition (debris, etc.) There are small trees, broken branches, stones, logs etc. on the down stream channel.

b. Slopes Downstream channel slopes are sometimes steep but no problem areas were observed.

c. Approximate number of homes There are numerous homes immediately down stream of the dam.

8) Miscellaneous The dam lies between 2 bridges. The upstream bridge is 39 feet from the dam and the downstream bridge is about 3000 feet from the dam. Both the bridges, in addition to the dam, will act as control points.

9) Structural

a. Concrete Surfaces Spillway surface - cracking observed above water or sanitary line which was excavated placed and covered after spillway construction. A void ≈ 10" diameter was found near east wingwall. spillway water was flowing into this void.

b. Structural Cracking Numerous structural cracks observed on both east & west abutment walls of spillway + southeast wingwall Bridge deck: observed extensive cracking & calcification

c. Movement - Horizontal & Vertical Alignment (Settlement) Bridge above spillway appears to have contracted relative to the abutment ad wingwall

d. Junctions with Abutments or Embankments no apparent problems

e. Drains - Foundation, Joint, Face None

f. Water passages, conduits, sluices 48" penstock on west side of spillway is inoperative & badly deteriorated. Seepage ≈ 5 gpm flows thru & under pipe; appears to be coming thru penstock pipe initially. 42" Reservoir drain under spillway is plugged w/ concrete

g. Seepage or Leakage seepage from Reservoir drain observed at a rate of 5 to 7 gpm, flow could be from void noted in "a" above or thru deteriorated end where spillway flow was entering. Void near reservoir drain is masonry: 6 to 8 inches wide x 2 feet x 3+ feet deep

h. Joints - Construction, etc. poor condition between bridge & abutment walls

i. Foundation bedrock

j. Abutments cracked as noted

k. Control Gates penstock - inoperative
Reservoir drain plugged w/ concrete

l. Approach & Outlet Channels appear in good condition
some debris in downstream channel

m. Energy Dissipators (plunge pool, etc.) none

n. Intake Structures none operational

o. Stability no adverse problems observed

p. Miscellaneous new highway bridge w/ steel pile wingwalls is protecting upstream face of the dam

APPENDIX D

HYDROLOGIC/HYDRAULIC

ENGINEERING DATA AND COMPUTATIONS

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

AREA-CAPACITY DATA:

	Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1) Top of Dam	1333	-	3758
2) Design High Water (Max. Design Pool)	-	-	-
3) Auxiliary Spillway Crest	-	-	-
4) Pool Level with Flashboards	1330	4908	3070
5) Service Spillway Crest	1326	3122	2168

DISCHARGES

	Volume (cfs)
1) Average Daily	15.30
2) Spillway @ Maximum High Water	500
3) Spillway @ Design High Water	-
4) Spillway @ Auxiliary Spillway Crest Elevation	-
5) Low Level Outlet	None Operational
6) Total (of all facilities) @ Maximum High Water	500
7) Maximum Known Flood	Unknown

CREST: DAM ELEVATION: 1333

Type: Earth embankment, downstream protected by stone masonry wall.

Width: Over 100 feet at top Length: 112 feet

Spillover See inspection checklist, Page 7

Location Eastern end of embankment

SPILLWAY:

PRINCIPAL		EMERGENCY
1326	Elevation	None
straight drop spillway	Type	
See Inspection checklist Page 7	Width	
	Type of Control	
—	Uncontrolled	
	Controlled:	
Stoplogs	Type (Flashboards; gate)	
6	Number	
8" high, over 4' long	Size/Length	
	Invert Material	
	Anticipated Length of operating service	
—	Chute Length	
3 feet	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	

OUTLET STRUCTURES/EMERGENCY DRAWDOWN FACILITIES:

Type: Gate _____ Sluice _____ Conduit _____ Penstock _____

Shape : None

Size: _____

Elevations: Entrance Invert —

Exit Invert —

Tailrace Channel: Elevation 1302

HYDROMETEROLOGICAL GAGES:

Type : None

Location: _____

Records:

Date - _____

Max. Reading - _____

FLOOD WATER CONTROL SYSTEM:

Warning System: None

_____

Method of Controlled Releases (mechanisms):

Stoplogs over the spillway controls the release of water downstream.

DRAINAGE AREA: 14.54 square miles

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: Mostly wooded

Terrain - Relief: Mild slopes

Surface - Soil: —

Runoff Potential (existing or planned extensive alterations to existing (surface or subsurface conditions)

None reported

Potential Sedimentation problem areas (natural or man-made; present or future)

None observed or reported

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

None reported

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter:

Location: None

Elevation:

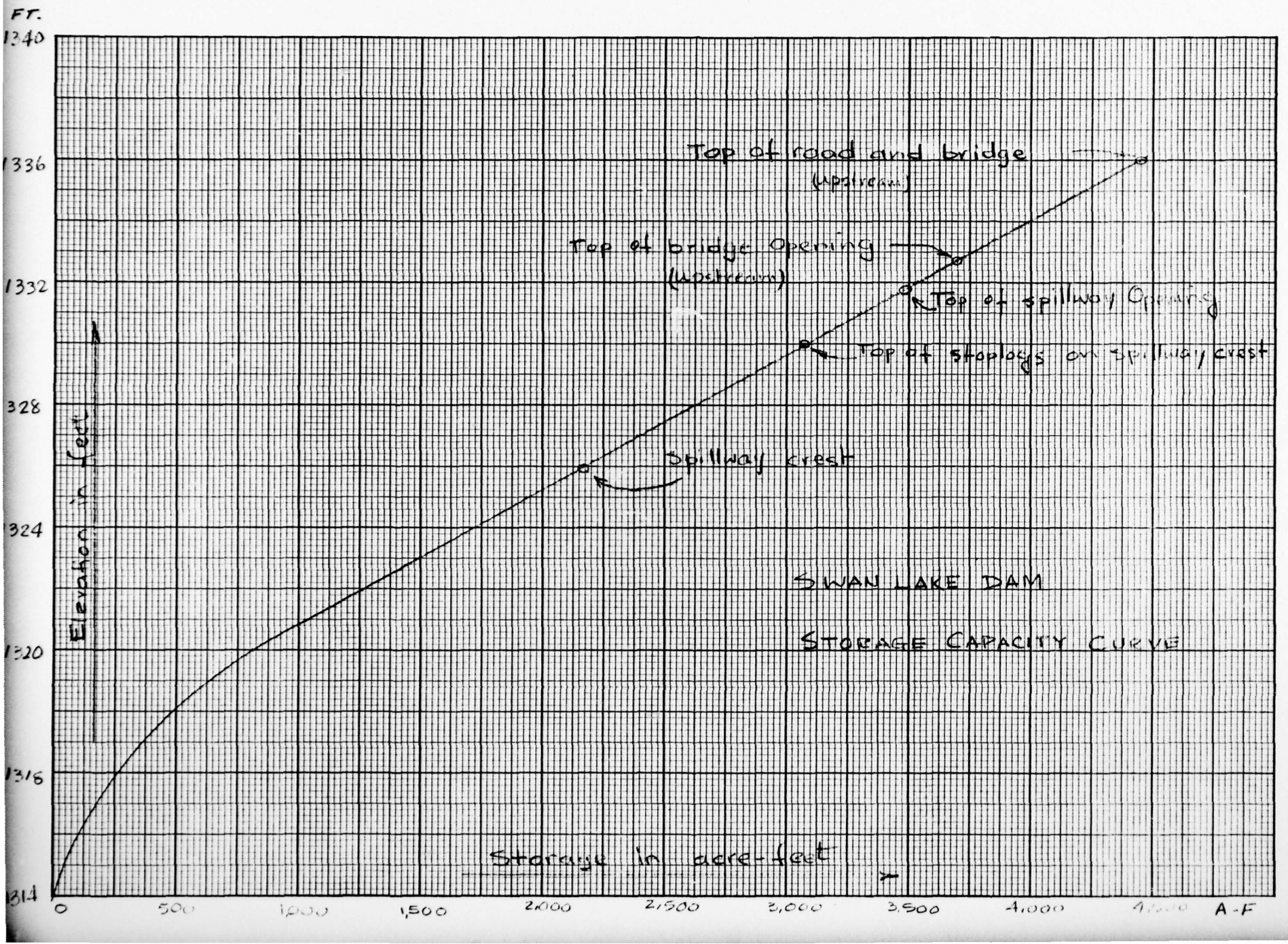
Reservoir:

Length @ Maximum Pool 2.8 (Miles)

Length of Shoreline (@ Spillway Crest) 6.2 (Miles)

STORAGE CAPACITY CURVE

Elevation (feet)	Storage (acre-feet)
1314	0
1320	810
1321	1034
1322	1258
1323	1482
1324	1708
1325	1933
1326	2168
1327	2387
1328	2614
1329	2842
1330	3070
1331	3299
1332	3528
1333	3758
1334	3989
1335	4219
1336	4451



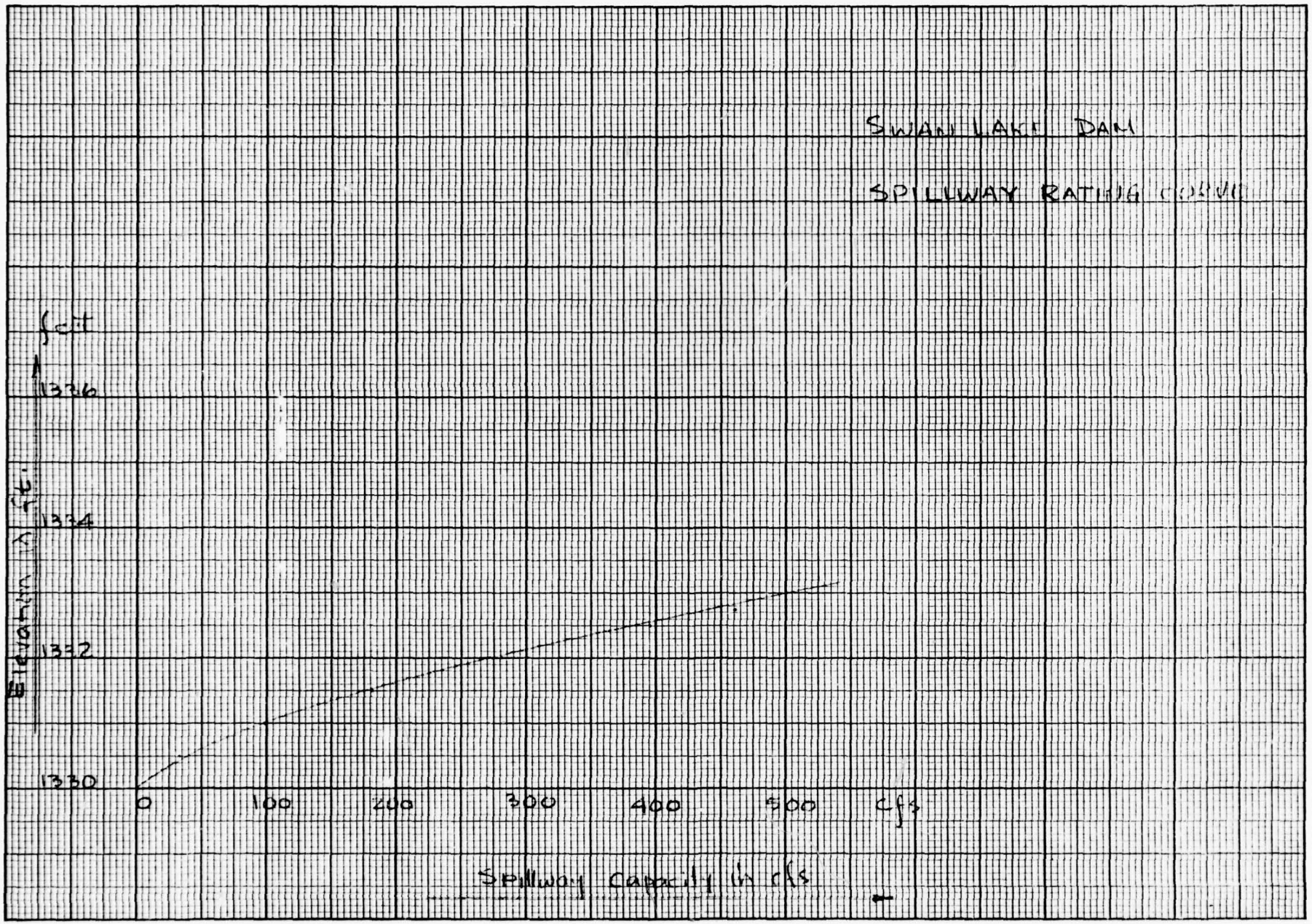
SPILLWAY RATING CURVE

$$C = 3.235 + \frac{1}{60H - .56} + .428\,\frac{H}{P}$$

$Q = CLH^{3/2}$ where C = Coefficient of discharge
H = Head over spillway
P = Height of spillway (upstream)
Q = Discharge over spillway
L = Length of spillway.

H in feet	P in feet	C	L in feet	Q in cfs.
.5	6.75	3.30	29.5	34
1.0	↓	3.32	↓	98
1.5		3.34		181
2.0		3.37		281
2.5		3.40		396
2.75		3.42		460
3.0		3.43		500
4.0		3.49		500
5.0		3.56		500
6.0		3.62		500

Flow above H≤3' was considered 500 cfs.



SWAN LAKE DAM

D.A. = Drainage area in square miles

L = River mileage from the given station to the upstream limits of the drainage area

L_{CA} = River mileage from the station to the center of gravity of the drainage area

PMP = Probable Maximum Precipitation in inches

t_p = Lag time from mid-point of unit rainfall duration, t_r, to peak of unit hydrograph, in hours.

t_r = Unit rainfall duration, equal to $\frac{t_p}{550}$, in hours.

C_t = Coefficient depending upon units and drainage basin characteristics

t_R = Unit rainfall duration other than standard unit, t_r, adopted in specific study, in hours.

t_{pR} = Lag time from mid-point of unit rainfall duration t_R, to peak of unit hydrograph, in hours

D.A = 14.54 square miles, L = 7.92 miles, L_{CA} = 3.54 miles

PMP = 21 inches C_t = 2,

C_p = 0.625 from average 640 C_p = 400

$t_p = C_t (L \cdot L_{CA})^{0.3} = 2(7.92 \times 3.54)^{0.3} = 5.44$ hours

$t_r = \frac{t_p}{5.5} = \frac{5.44}{5.5} = .99$ hours (Use 1 hr. hydrograph)

$t_{pR} = t_p + 0.25(t_R - t_r) = 5.44 + .25(1 - .99) = 5.44$ hrs.

From HMR 33 - Figure 2, Depth - Area - Duration

6 hour % 108 = , 12 hour % = 120

24 hour % 130 = , 48 hour % = 139.5

```
**************************
HYDROGRAPH PACKAGE (HEC-1)
SAFETY VERSION     JULY 1976
 MODIFICATION  25 SEP 78
**************************
A1       SWAN LAKE DAM  NY-333  DELAWARE
A2       HYDROLOGIC/HYDRAULIC ANALYSIS OF SAFETY OF SWAN LAKE DAM
A3       RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM
B     100        1        0        0        0        0        0        0        0        0
B1      5
J       1        2        1
J1     .5        1
K       0        1                                                  1
K1       CALCULATION OF INFLOW HYDROGRAPH TO SWAN LAKE
M       1        1    14.54             14.54                                          1
P                21      108      120      130    139.5
T                                                          1       .1
W    5.44     .625
X   29.08    29.08        1
K       1        2                                                  1
K1       ROUTED FLOWS THROUGH SWAN LAKE
Y                                 1        1
Y1      1                                                       -1330       -1
Y4   1330   1330.5     1331   1331.5     1332   1332.5  1332.75     1333     1334     1335
Y4   1335
Y5      0       34       98      181      281      396      460      500      500      500
Y5    500
S5      0      810     1034     1256     1482     1708     1933     2168     2387     2614
S5   2842     3070     3299     3528     3758     3989     4219     4451
SE   1314     1320     1321     1322     1323     1324     1325     1326     1327     1328
SE   1329     1330     1331     1332     1333     1334     1335     1336
S5   1330     29.5      3.4      1.5
S5   1330      9.3      1.5     1000
K       1        3                                                  1
K1       SPILLWAY ROUTING-SPILLWAY ASSUMED AS EQUIVALENT CHANNEL-4FT STOPLOGS
Y                                 1        1
Y1      1
Y5    .04     .013      .04  1329.96     1340       39     .001
Y7      0     1334     44.8     1333     44.9  1331.76       45  1329.96       68  1329.96
Y7   68.1  1331.76     68.2     1333     1000     1333
K       1        4                                                  1
K1       CHANNEL ROUTING MOD-PULS REACH 3-4 DOWNSTREAM BRIDGE
Y                                 1        1
Y1      1
Y5    .04      .05      .04     1281     1312     2000    .0095
Y7      0     1291       80     1289      110     1289    110.1     1281      133     1281
Y7  133.1     1289      291     1290     1341     1312
K      99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	1
ROUTE HYDROGRAPH TO	2
ROUTE HYDROGRAPH TO	3
ROUTE HYDROGRAPH TO	4
END OF NETWORK	

TEO 03/07/79
TEO 19.14.15.

SWAN LAKE DAM NY-333 DELAWARE
HYDROLOGIC/HYDRAULIC ANALYSIS OF SAFETY OF SWAN LAKE DAM
RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	1	0	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 2 LRTIO= 1
RTIOS= .50 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

CALCULATION OF INFLOW HYDROGRAPH TO SWAN LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	14.54	0.00	14.54	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.00	108.00	120.00	130.00	139.50	0.00	0.00

OMPUTED BY THE PROGRAM IS .813

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.10	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 5.44 CP= .63 NTA= 0

RECESSION DATA
STRTQ= 29.08 QRCSN= 29.08 RTIOR= 1.00
MATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 6.36 AND R= 4.97 INTERVALS

UNIT HYDROGRAPH 30 END-OF-PERIOD ORDINATES, LAG= 5.47 HOURS, CP= .63 VOL= 1.00

76.	275.	542.	812.	1008.	1082.	1004.	837.	684.	559.
457.	373.	305.	249.	204.	167.	136.	111.	91.	74.
61.	50.	41.	33.	27.	22.	18.	15.	12.	10.

0 END-OF-PERIOD FLOW

NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

1.01	1.00	1	.01	0.00	.01	29.	1.03	3.00	51	0.00	0.00	0.00	7053.
1.01	2.00	2	.01	0.00	.01	29.	1.03	4.00	52	0.00	0.00	0.00	5822.
1.01	3.00	3	.01	0.00	.01	29.	1.03	5.00	53	0.00	0.00	0.00	4791.
1.01	4.00	4	.01	0.00	.01	29.	1.03	6.00	54	0.00	0.00	0.00	3930.
1.01	5.00	5	.01	0.00	.01	29.	1.03	7.00	55	0.00	0.00	0.00	3218.
1.01	6.00	6	.01	0.00	.01	29.	1.03	8.00	56	0.00	0.00	0.00	2635.
1.01	7.00	7	.02	0.00	.02	29.	1.03	9.00	57	0.00	0.00	0.00	2159.
1.01	8.00	8	.02	0.00	.02	29.	1.03	10.00	58	0.00	0.00	0.00	1769.
1.01	9.00	9	.02	0.00	.02	29.	1.03	11.00	59	0.00	0.00	0.00	1451.
1.01	10.00	10	.02	0.00	.02	29.	1.03	12.00	60	0.00	0.00	0.00	1191.
1.01	11.00	11	.02	0.00	.02	29.	1.03	13.00	61	0.00	0.00	0.00	977.
1.01	12.00	12	.02	0.00	.02	29.	1.03	14.00	62	0.00	0.00	0.00	802.
1.01	13.00	13	.13	0.00	.13	29.	1.03	15.00	63	0.00	0.00	0.00	658.
1.01	14.00	14	.16	0.00	.16	29.	1.03	16.00	64	0.00	0.00	0.00	541.
1.01	15.00	15	.20	0.00	.20	29.	1.03	17.00	65	0.00	0.00	0.00	446.
1.01	16.00	16	.51	.17	.34	42.	1.03	18.00	66	0.00	0.00	0.00	366.
1.01	17.00	17	.19	.09	.10	82.	1.03	19.00	67	0.00	0.00	0.00	292.
1.01	18.00	18	.15	.05	.10	149.	1.03	20.00	68	0.00	0.00	0.00	227.
1.01	19.00	19	.01	0.00	.01	223.	1.03	21.00	69	0.00	0.00	0.00	169.
1.01	20.00	20	.01	0.00	.01	297.	1.03	22.00	70	0.00	0.00	0.00	88.
1.01	21.00	21	.01	0.00	.01	340.	1.03	23.00	71	0.00	0.00	0.00	57.
1.01	22.00	22	.01	0.00	.01	343.	1.04	0.00	72	0.00	0.00	0.00	36.
1.01	23.00	23	.01	0.00	.01	312.	1.04	1.00	73	0.00	0.00	0.00	35.
1.02	0.00	24	.01	0.00	.01	267.	1.04	2.00	74	0.00	0.00	0.00	33.
1.02	1.00	25	.11	.01	.10	225.	1.04	3.00	75	0.00	0.00	0.00	32.
1.02	2.00	26	.11	.01	.10	194.	1.04	4.00	76	0.00	0.00	0.00	31.
1.02	3.00	27	.11	.01	.10	172.	1.04	5.00	77	0.00	0.00	0.00	30.
1.02	4.00	28	.11	.01	.10	159.	1.04	6.00	78	0.00	0.00	0.00	29.
1.02	5.00	29	.11	.01	.10	154.	1.04	7.00	79	0.00	0.00	0.00	29.
1.02	6.00	30	.11	.01	.10	153.	1.04	8.00	80	0.00	0.00	0.00	29.
1.02	7.00	31	.34	.24	.10	171.	1.04	9.00	81	0.00	0.00	0.00	29.
1.02	8.00	32	.34	.24	.10	234.	1.04	10.00	82	0.00	0.00	0.00	29.
1.02	9.00	33	.34	.24	.10	358.	1.04	11.00	83	0.00	0.00	0.00	29.
1.02	10.00	34	.34	.24	.10	544.	1.04	12.00	84	0.00	0.00	0.00	29.
1.02	11.00	35	.34	.24	.10	774.	1.04	13.00	85	0.00	0.00	0.00	29.
1.02	12.00	36	.34	.24	.10	1020.	1.04	14.00	86	0.00	0.00	0.00	29.
1.02	13.00	37	1.84	1.74	.10	1363.	1.04	15.00	87	0.00	0.00	0.00	29.
1.02	14.00	38	2.21	2.11	.10	1995.	1.04	16.00	88	0.00	0.00	0.00	29.
1.02	15.00	39	2.77	2.67	.10	3100.	1.04	17.00	89	0.00	0.00	0.00	29.
1.02	16.00	40	7.01	6.91	.10	5128.	1.04	18.00	90	0.00	0.00	0.00	29.
1.02	17.00	41	2.58	2.48	.10	8179.	1.04	19.00	91	0.00	0.00	0.00	29.
1.02	18.00	42	2.03	1.93	.10	11748.	1.04	20.00	92	0.00	0.00	0.00	29.
1.02	19.00	43	.17	.07	.10	15035.	1.04	21.00	93	0.00	0.00	0.00	29.
1.02	20.00	44	.17	.07	.10	17183.	1.04	22.00	94	0.00	0.00	0.00	29.
1.02	21.00	45	.17	.07	.10	17795.	1.04	23.00	95	0.00	0.00	0.00	29.
1.02	22.00	46	.17	.07	.10	16792.	1.05	0.00	96	0.00	0.00	0.00	29.
1.02	23.00	47	.17	.07	.10	14729.	1.05	1.00	97	0.00	0.00	0.00	29.
1.03	0.00	48	.17	.07	.10	12426.	1.05	2.00	98	0.00	0.00	0.00	29.
1.03	1.00	49	0.00	0.00	0.00	10306.	1.05	3.00	99	0.00	0.00	0.00	29.
1.03	2.00	50	0.00	0.00	0.00	8528.	1.05	4.00	100	0.00	0.00	0.00	29.
									SUM	23.81	20.10	3.72	190481.
										(605.)(	510.)(	94.)(	5393.82)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	17795.	15604.	7427.	2634.	190452.
CMS	504.	442.	210.	75.	5393.
INCHES		9.98	19.01	20.22	20.31

15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
15.	15.	15.	15.	15.	15.	15.	15.	15.	15.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8593.	7802.	3714.	1317.	95226.
CMS	252.	221.	105.	37.	2696.
INCHES		4.09	9.50	10.11	10.15
MM		126.79	241.39	256.84	257.91
AC-FT		3869.	7366.	7837.	7870.
THOUS CU M		4772.	9086.	9667.	9707.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 2

29.	29.	29.	29.	29.	29.	29.	29.	29.	29.
29.	29.	29.	29.	29.	42.	82.	149.	228.	297.
340.	343.	312.	267.	225.	194.	172.	159.	154.	153.
171.	234.	356.	544.	774.	1020.	1363.	1995.	3108.	5128.
8179.	11748.	15035.	17180.	17795.	16792.	14729.	12426.	10306.	8528.
7053.	5822.	4791.	3930.	3218.	2635.	2159.	1769.	1451.	1191.
977.	802.	658.	541.	446.	368.	292.	227.	169.	88.
57.	36.	35.	33.	32.	31.	30.	29.	29.	29.
29.	29.	29.	29.	29.	29.	29.	29.	29.	29.
29.	29.	29.	29.	29.	29.	29.	29.	29.	29.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	17795.	15604.	7427.	2634.	190452.
CMS	504.	442.	210.	75.	5393.
INCHES		9.98	19.01	20.22	20.31
MM		253.58	482.78	513.69	515.82
AC-FT		7738.	14732.	15675.	15740.
THOUS CU M		9544.	18171.	19335.	19415.

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HYDROGRAPH ROUTING

ROUTED FLOWS THROUGH SWAN LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1330.	-1

TAGE	1330.00	1330.50	1331.00	1331.50	1332.00	1332.50	1332.75	1333.00	1334.00	1335.00
	1336.00									
FLOW	0.00	34.00	98.00	181.00	281.00	396.00	460.00	500.00	500.00	500.00
	500.00									

	2492.	3070.	[illegible]	3526.	3758.	3989.	4219.	4451.		
ELEVATION=	1314.	1320.	1321.	1322.	1323.	1324.	1325.	1326.	1327.	1328.
	1329.	1330.	1331.	1332.	1333.	1334.	1335.	1336.		

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1330.0	29.5	3.4	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1336.0	3.3	1.5	1000.

STATION 2, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	1.	1.	1.	2.	2.	2.	3.	3.	3.
3.	4.	4.	4.	4.	5.	5.	7.	9.	12.
15.	19.	23.	26.	26.	30.	31.	33.	34.	35.
37.	40.	45.	53.	66.	83.	109.	151.	223.	361.
500.	500.	2616.	8013.	8806.	8633.	7821.	6730.	5654.	4713.
3927.	3271.	2721.	2259.	1875.	1556.	1295.	1080.	905.	763.
649.	561.	506.	500.	500.	500.	500.	500.	500.	500.
500.	500.	500.	500.	500.	500.	500.	500.	500.	500.
500.	500.	492.	455.	428.	392.	362.	335.	309.	286.
266.	249.	232.	217.	203.	190.	178.	169.	160.	151.

STORAGE

3071.	3072.	3073.	3075.	3076.	3077.	3078.	3079.	3080.	3081.
3082.	3082.	3083.	3084.	3085.	3086.	3088.	3093.	3100.	3110.
3122.	3134.	3146.	3156.	3164.	3170.	3175.	3180.	3183.	3187.
3191.	3196.	3204.	3219.	3241.	3272.	3314.	3372.	3462.	3608.
3847.	4218.	4634.	4853.	4880.	4874.	4846.	4805.	4763.	4724.
4689.	4657.	4629.	4604.	4580.	4560.	4541.	4524.	4508.	4494.
4480.	4467.	4453.	4437.	4416.	4391.	4364.	4333.	4300.	4264.
4225.	4186.	4146.	4106.	4066.	4026.	3986.	3946.	3906.	3866.
3826.	3786.	3746.	3708.	3672.	3639.	3609.	3582.	3556.	3533.
3511.	3491.	3472.	3455.	3439.	3424.	3410.	3397.	3384.	3373.

STAGE

1330.0	1330.0	1330.0	1330.0	1330.0	1330.0	1330.0	1330.0	1330.0	1330.0
1330.1	1330.1	1330.1	1330.1	1330.1	1330.1	1330.1	1330.1	1330.1	1330.2
1330.2	1330.3	1330.3	1330.4	1330.4	1330.4	1330.5	1330.5	1330.5	1330.5
1330.5	1330.5	1330.6	1330.7	1330.7	1330.9	1331.1	1331.3	1331.7	1332.3
1333.4	1335.0	1336.8	1337.7	1337.9	1337.8	1337.7	1337.5	1337.3	1337.2
1337.0	1336.9	1336.8	1336.7	1336.6	1336.5	1336.4	1336.3	1336.2	1336.2
1336.1	1336.1	1336.0	1335.9	1335.8	1335.7	1335.6	1335.5	1335.3	1335.2
1335.0	1334.9	1334.7	1334.5	1334.3	1334.2	1334.0	1333.8	1333.6	1333.5
1333.3	1333.1	1332.9	1332.8	1332.6	1332.5	1332.4	1332.2	1332.1	1332.0
1331.9	1331.8	1331.8	1331.7	1331.6	1331.5	1331.5	1331.4	1331.4	1331.3

OUTFLOW IS 8806. AT TIME 45.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8806.	7373.	3169.	1268.	91580.
CMS	249.	209.	90.	36.	2593.
INCHES	[illegible]	4.73	2.11	0.74	0.77

97.	103.	114.	134.	164.	212.	280.	391.	500.	500.
1709.	9850.	13591.	16519.	17689.	17213.	15476.	13247.	11091.	9225.
7672.	6375.	5285.	4377.	3617.	2989.	2473.	2049.	1701.	1415.
1181.	988.	831.	704.	603.	529.	500.	500.	500.	500.
500.	500.	500.	500.	500.	500.	500.	500.	500.	500.
500.	500.	500.	500.	500.	497.	471.	439.	403.	372.
345.	320.	297.	276.	259.	243.	228.	214.	201.	189.

STORAGE

3072.	3075.	3077.	3079.	3081.	3083.	3085.	3087.	3089.	3091.
3093.	3095.	3097.	3098.	3100.	3102.	3107.	3115.	3129.	3149.
3174.	3199.	3222.	3241.	3255.	3266.	3275.	3281.	3287.	3292.
3297.	3306.	3321.	3348.	3390.	3449.	3527.	3638.	3812.	4111.
4570.	4915.	5041.	5116.	5148.	5135.	5087.	5022.	4956.	4895.
4840.	4792.	4748.	4709.	4674.	4643.	4616.	4591.	4569.	4550.
4532.	4516.	4501.	4487.	4474.	4461.	4446.	4426.	4401.	4370.
4335.	4297.	4259.	4220.	4182.	4143.	4104.	4065.	4026.	3987.
3948.	3910.	3871.	3832.	3793.	3754.	3716.	3681.	3649.	3619.
3592.	3567.	3544.	3523.	3503.	3485.	3467.	3452.	3437.	3423.

STAGE

1330.0	1330.0	1330.0	1330.0	1330.0	1330.1	1330.1	1330.1	1330.1	1330.1
1330.1	1330.1	1330.1	1330.1	1330.1	1330.1	1330.2	1330.2	1330.3	1330.3
1330.5	1330.6	1330.7	1330.7	1330.8	1330.9	1330.9	1330.9	1330.9	1331.0
1331.0	1331.0	1331.1	1331.2	1331.4	1331.7	1332.0	1332.5	1333.2	1334.5
1336.5	1336.0	1336.5	1336.9	1339.0	1338.9	1338.7	1338.5	1338.2	1337.9
1337.7	1337.5	1337.3	1337.1	1337.0	1336.8	1336.7	1336.6	1336.5	1336.4
1336.3	1336.3	1336.2	1336.2	1336.1	1336.0	1336.0	1335.9	1335.8	1335.7
1335.5	1335.3	1335.2	1335.0	1334.8	1334.7	1334.5	1334.3	1334.2	1334.0
1333.8	1333.7	1333.5	1333.3	1333.2	1333.0	1332.8	1332.7	1332.5	1332.4
1332.3	1332.2	1332.1	1332.0	1331.9	1331.8	1331.7	1331.7	1331.6	1331.5

OUTFLOW IS 17689. AT TIME 45.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	17689.	15439.	6978.	2578.	186211.
CMS	501.	437.	198.	73.	5273.
INCHES		9.88	17.86	19.79	19.86
MM		250.89	453.56	502.64	504.33
AC-FT		7656.	13840.	15338.	15389.
THOUS CU M		9443.	17072.	18919.	18982.

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HYDROGRAPH ROUTING

SPILLWAY ROUTING-SPILLWAY ASSUMED AS EQUIVALENT CHANNEL-4FT STOPLOGS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

	NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
	1	0	0	0.000	0.000	0.000	0.	0

MAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0400	.0130	.0400	1330.0	1340.0	39.	.00100

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 1334.00 -4.90 1333.00 44.90 1331.76 45.00 1329.96 68.00 1329.96
68.10 1331.76 88.20 1333.00 1000.00 1333.00

STORAGE	0.00	.01	.02	.03	.04	.05	.18	.64	1.11	1.58
	2.05	2.53	3.00	3.47	3.94	4.42	4.89	5.36	5.84	6.31
OUTFLOW	0.00	28.00	86.56	165.88	265.55	385.66	559.98	1229.46	2334.13	3799.07
	5578.68	7645.33	9981.17	12569.56	15398.95	18459.32	21742.11	25239.95	28946.35	32855.54
STAGE	1329.90	1330.49	1331.02	1331.55	1332.07	1332.60	1333.13	1333.66	1334.19	1334.72
	1335.24	1335.77	1336.30	1336.83	1337.36	1337.89	1338.41	1338.94	1339.47	1340.00
FLOW	0.00	28.00	86.56	165.83	265.55	385.66	559.98	1229.46	2334.13	3799.07
	5578.68	7645.33	9981.17	12569.56	15398.95	18459.32	21742.11	25239.95	28946.35	32855.54

STATION 3, PLAN 1, RTIO 1

OUTFLOW

1.	0.	1.	1.	2.	2.	3.	2.	3.	3.
4.	3.	4.	4.	5.	5.	6.	6.	9.	12.
16.	19.	23.	25.	28.	30.	32.	32.	34.	35.
38.	40.	45.	53.	66.	83.	109.	151.	224.	361.
498.	501.	2788.	8009.	8806.	8634.	7824.	6733.	5657.	4716.
3930.	3274.	2722.	2262.	1877.	1558.	1296.	1082.	906.	764.
650.	562.	504.	500.	500.	500.	500.	500.	500.	500.
500.	500.	500.	500.	500.	500.	500.	500.	500.	500.
500.	500.	492.	465.	428.	392.	362.	335.	309.	286.
266.	249.	232.	217.	205.	190.	178.	169.	160.	152.

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	1.	3.	3.	3.	3.	2.	2.	2.
2.	1.	1.	1.	1.	1.	1.	1.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

STAGE

1330.0	1330.0	1330.0	1330.0	1330.0	1330.0	1330.0	1330.0	1330.0	1330.0

AC-FT	3655.	6285.	7547.	7569.
THOUS CU M	4509.	7753.	9309.	9336.

MAXIMUM STORAGE = 3.

STAGE IS 1336.0

STATION 3, PLAN 1, RTIO 2

OUTFLOW

1.	1.	3.	2.	4.	3.	5.	5.	6.	6.
7.	7.	8.	8.	9.	9.	11.	13.	18.	23.
31.	41.	55.	65.	74.	79.	85.	88.	92.	93.
97.	102.	114.	133.	165.	211.	281.	390.	499.	501.
1691.	9817.	13907.	10493.	17711.	17194.	15502.	13230.	11117.	9208.
7696.	6358.	5311.	4360.	3639.	2972.	2493.	2033.	1720.	1399.
1199.	973.	847.	690.	618.	516.	513.	487.	513.	488.
512.	489.	511.	489.	510.	490.	510.	491.	509.	491.
508.	492.	506.	492.	507.	490.	478.	432.	409.	366.
352.	314.	303.	270.	265.	237.	234.	208.	208.	183.

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	3.	4.	4.	4.	4.	4.	4.	3.	3.
3.	2.	2.	2.	2.	1.	1.	1.	1.	1.
1.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

STAGE

1330.0	1330.0	1330.0	1330.0	1330.0	1330.0	1330.1	1330.0	1330.1	1330.1
1330.1	1330.1	1330.1	1330.1	1330.1	1330.1	1330.2	1330.2	1330.3	1330.4
1330.5	1330.6	1330.7	1330.8	1330.9	1331.0	1331.0	1331.0	1331.1	1331.1
1331.1	1331.1	1331.2	1331.3	1331.5	1331.8	1332.1	1332.6	1332.9	1333.0
1333.9	1336.3	1337.1	1337.5	1337.8	1337.7	1337.4	1337.0	1336.5	1336.1
1335.8	1335.4	1335.2	1334.9	1334.7	1334.4	1334.2	1334.0	1333.9	1333.7
1333.6	1333.5	1333.4	1333.2	1333.2	1333.0	1333.0	1332.9	1333.0	1332.9
1333.0	1332.9	1333.0	1332.9	1333.0	1332.9	1333.0	1332.9	1333.0	1332.9
1333.0	1332.9	1333.0	1332.9	1333.0	1332.9	1332.9	1332.7	1332.7	1332.5
1332.5	1332.3	1332.2	1332.1	1332.1	1331.9	1331.9	1331.8	1331.8	1331.6

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	17711.	15440.	6978.	2578.	186210.
CMS	502.	437.	198.	73.	5273.
INCHES		9.38	17.86	19.79	19.86
MM		250.91	453.56	502.64	504.33
AC-FT		7656.	13840.	15338.	15389.
THOUS CU M		9444.	17072.	18919.	18982.

STAGE IS 1287.8

********** *********** ********** ********* **********

HYDROGRAPH ROUTING

CHANNEL ROUTING MOD-PULS REACH 3-4 DOWNSTREAM BRIDGE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

DEPTH CHANNEL ROUTING

QO(1)	QO(2)	QO(3)	ELMVT	ELMAX	RLNTH	SEL
.0400	.0500	.0400	1281.0	1312.0	2000.	.00950

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 1291.00 80.00 1289.00 110.00 1289.00 110.10 1281.00 133.00 1281.00
133.10 1289.00 291.00 1290.00 1341.00 1312.00

RAGE	0.00	1.72	3.44	5.16	6.89	8.95	25.78	53.26	86.65	125.86
	170.90	221.77	278.48	341.02	409.39	483.59	563.63	649.51	741.21	838.75
FLOW	0.00	137.83	405.19	743.60	1128.92	1562.53	3436.53	8503.67	16586.90	28150.63
	43148.31	61946.08	84810.67	112005.45	143738.98	180414.67	222130.73	269180.38	321802.06	380229.69
TAGE	1281.00	1282.63	1284.26	1285.89	1287.53	1289.16	1290.79	1292.42	1294.05	1295.68
	1297.32	1298.95	1300.58	1302.21	1303.84	1305.47	1307.11	1308.74	1310.37	1312.00
FLOW	0.00	137.83	405.19	743.60	1128.92	1562.53	3436.53	8503.67	16586.90	28150.63
	43148.31	61946.08	84810.67	112005.45	143738.98	180414.67	222130.73	269180.38	321802.06	380229.69

STATION 4, PLAN 1, RTIO 1

OUTFLOW

1.	0.	1.	1.	2.	2.	2.	3.	3.	3.
3.	4.	4.	4.	4.	5.	5.	6.	8.	11.
15.	19.	22.	25.	28.	30.	31.	32.	34.	35.
37.	40.	44.	52.	64.	80.	104.	144.	219.	346.
493.	503.	2466.	7576.	9063.	8441.	8067.	6674.	5828.	4695.
4037.	3277.	2817.	2283.	1932.	1579.	1307.	1095.	913.	773.
655.	567.	506.	499.	501.	499.	501.	499.	500.	500.

STAGE

1281.0	1281.0	1281.0	1281.0	1281.0	1281.0	1281.0	1281.0	1281.0	1281.0
1281.0	1281.0	1281.0	1281.0	1281.1	1281.1	1281.1	1281.1	1281.1	1281.1
1281.2	1281.2	1281.3	1281.3	1281.3	1281.4	1281.4	1281.4	1281.4	1281.4
1281.4	1281.5	1281.5	1281.6	1281.8	1281.9	1282.2	1282.7	1283.1	1283.9
1284.7	1284.7	1289.9	1292.1	1292.5	1292.4	1292.3	1291.8	1291.6	1291.2
1291.0	1290.7	1290.3	1289.3	1287.5	1289.2	1288.2	1287.4	1286.6	1286.0
1285.5	1285.0	1284.7	1284.7	1284.7	1284.7	1284.7	1284.7	1284.7	1284.7
1284.7	1284.7	1284.7	1284.7	1284.7	1284.7	1284.7	1284.7	1284.7	1284.7
1284.7	1284.7	1284.7	1284.6	1284.4	1284.2	1284.0	1283.8	1283.7	1283.5
1283.4	1283.3	1283.2	1283.1	1283.0	1283.0	1282.9	1282.8	1282.8	1282.7

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	9063.	7368.	3169.	1268.	91558.
CMS	257.	209.	90.	36.	2593.
INCHES		4.71	8.11	9.74	9.76
MM		119.73	205.98	247.27	247.97
AC-FT		3653.	6285.	7545.	7567.
THOUS CU M		4506.	7753.	9307.	9334.

MAXIMUM STORAGE = 56.

M STAGE IS 1292.5

STATION 4, PLAN 1, RTIO 2

OUTFLOW

2.	0.	2.	2.	3.	4.	5.	5.	6.	6.
7.	7.	8.	8.	9.	10.	11.	13.	17.	23.
30.	40.	53.	64.	72.	79.	84.	88.	91.	94.
96.	102.	112.	130.	162.	207.	274.	380.	494.	505.
1566.	8937.	14343.	15903.	13107.	16898.	15893.	13113.	11403.	9145.
7901.	6355.	5435.	4376.	3711.	3026.	2544.	2082.	1744.	1430.
1195.	999.	839.	712.	609.	534.	499.	501.	499.	501.
499.	501.	499.	501.	499.	501.	499.	501.	499.	501.
499.	501.	499.	501.	499.	499.	473.	441.	405.	375.
347.	322.	298.	278.	260.	245.	229.	216.	202.	190.

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	2.	2.	2.	3.	3.	4.	4.
9.	55.	77.	83.	92.	87.	83.	72.	65.	56.
50.	42.	37.	31.	27.	22.	18.	14.	11.	8.
7.	6.	6.	5.	4.	4.	4.	4.	4.	4.
4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	4.	4.	4.	4.	4.	4.	3.	3.
3.	3.	3.	3.	3.	2.	2.	2.	2.	2.

STAGE

1281.0	1281.0	1281.0	1281.0	1281.0	1281.0	1281.1	1281.1	1281.1	1281.1
1281.1	1281.1	1281.1	1281.1	1281.1	1281.1	1281.1	1281.2	1281.2	1281.3
1281.3	1281.5	1281.6	1281.8	1281.9	1281.9	1282.0	1282.0	1282.1	1282.1

1292.2	1292.5	1293.6	1293.9	1294.3	1294.1	1293.9	1293.3	1293.0	1292.5
1292.2	1291.7	1291.9	1291.1	1290.9	1290.4	1290.0	1289.6	1289.3	1288.7
1287.3	1287.0	1286.3	1285.7	1285.2	1284.9	1284.7	1284.7	1284.7	1284.7
1284.7	1284.7	1284.7	1284.7	1284.7	1284.7	1284.7	1284.7	1284.7	1284.7
1284.7	1284.7	1284.7	1284.7	1284.7	1284.7	1284.6	1284.4	1284.3	1284.1
1283.9	1283.8	1283.6	1283.5	1283.4	1283.3	1283.2	1283.1	1283.0	1283.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	18107.	15464.	6977.	2577.	186186.
CMS	513.	438.	198.	73.	5272.
INCHES		9.89	17.86	19.79	19.85
MM		251.30	453.32	502.60	504.26
AC-FT		7666.	13839.	15337.	15387.
THOUS CU M		9459.	17070.	18918.	18980.

MAXIMUM STORAGE = 92.

MUM STAGE IS 1294.3

********** ********** ********** ********** **********

AREA IN SQUARE MILES (SQUARE KILOMETERS)

ION	STATION	AREA	PLAN	RATIO 1 .50	RATIO 2 1.00
				RATIOS APPLIED TO FLOWS	
KAPH AT	1	14.54	1	8898.	17795.
		(37.66)		(251.96)(	503.91)(
TU	2	14.54	1	8806.	17689.
		(37.66)		(249.37)(	500.91)(
TU	3	14.54	1	8805.	17711.
		(37.66)		(249.37)(	501.52)(
TU	4	14.54	1	9063.	18107.
		(37.66)		(256.63)(	512.72)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1330.00	1330.00	1336.00
STORAGE	3070.	3070.	4451.
OUTFLOW	0.	0.	500.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1337.85	1.85	4880.	8806.	21.00	45.00	0.00
1.00	1339.00	3.00	5148.	17689.	26.00	45.00	0.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	8806.	1336.0	45.00
1.00	17711.	1337.8	45.00

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	9063.	1292.5	45.00
1.00	18107.	1294.3	45.00

LIST OF REFERENCES

APPENDIX E

APPENDIX E

REFERENCES

1) U.S. Department of Commerce, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, May 1961.

2) Soil Conservation Service, National Engineering Handbook, Section 4, Hydrology, August 1972 (U.S. Department of Agriculture).

3) H.W. King and E.F. Brater, Handbook of Hydraulics, 5th edition, McGraw-Hill, 1963.

4) T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley and Sons, 1965.

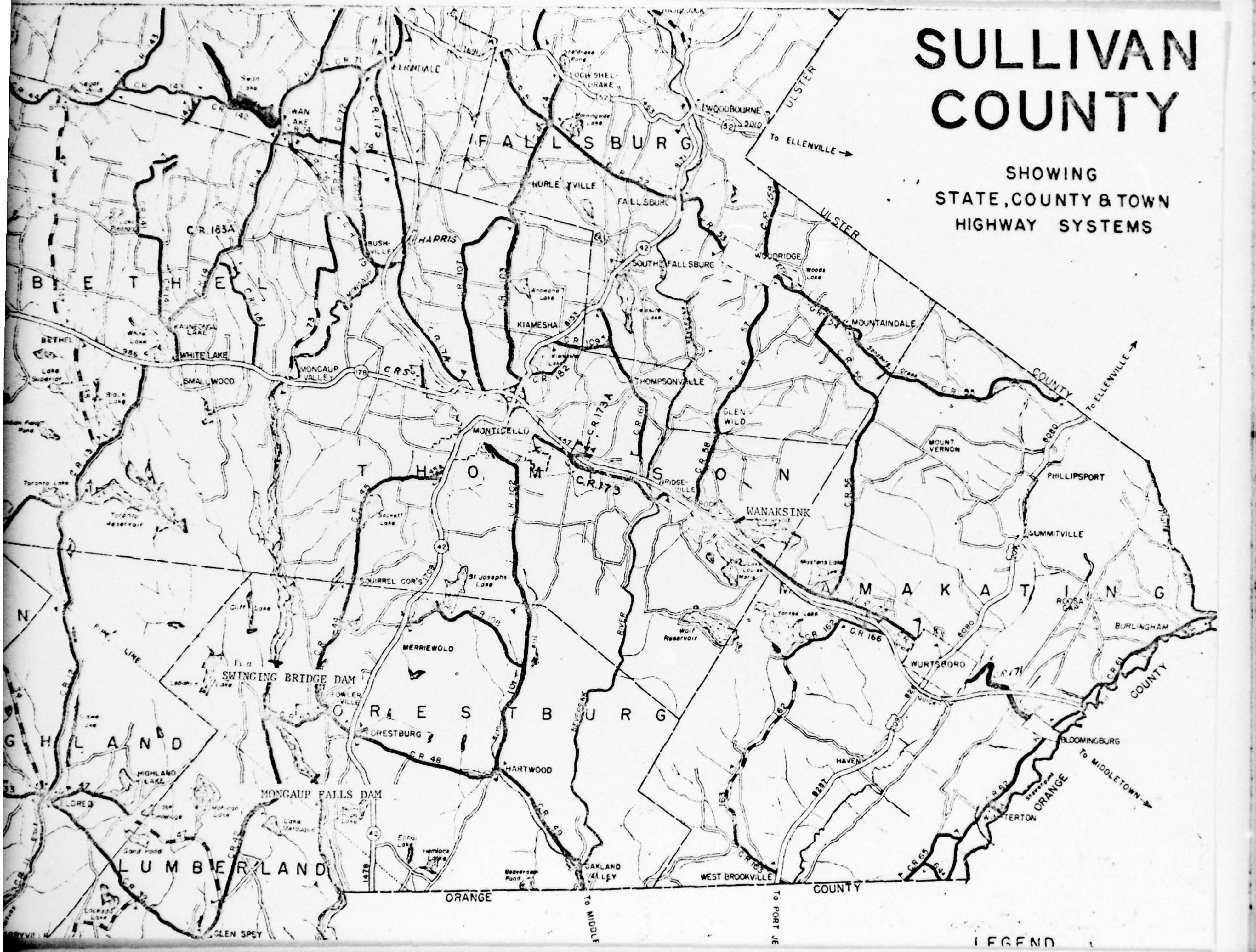
5) W.D. Thornbury, Principles of Geomorphology, John Wiley and Sons, 1969.

6) University of the State of New York, Geology of New York, Education Leaflet 20, Reprinted 1973.

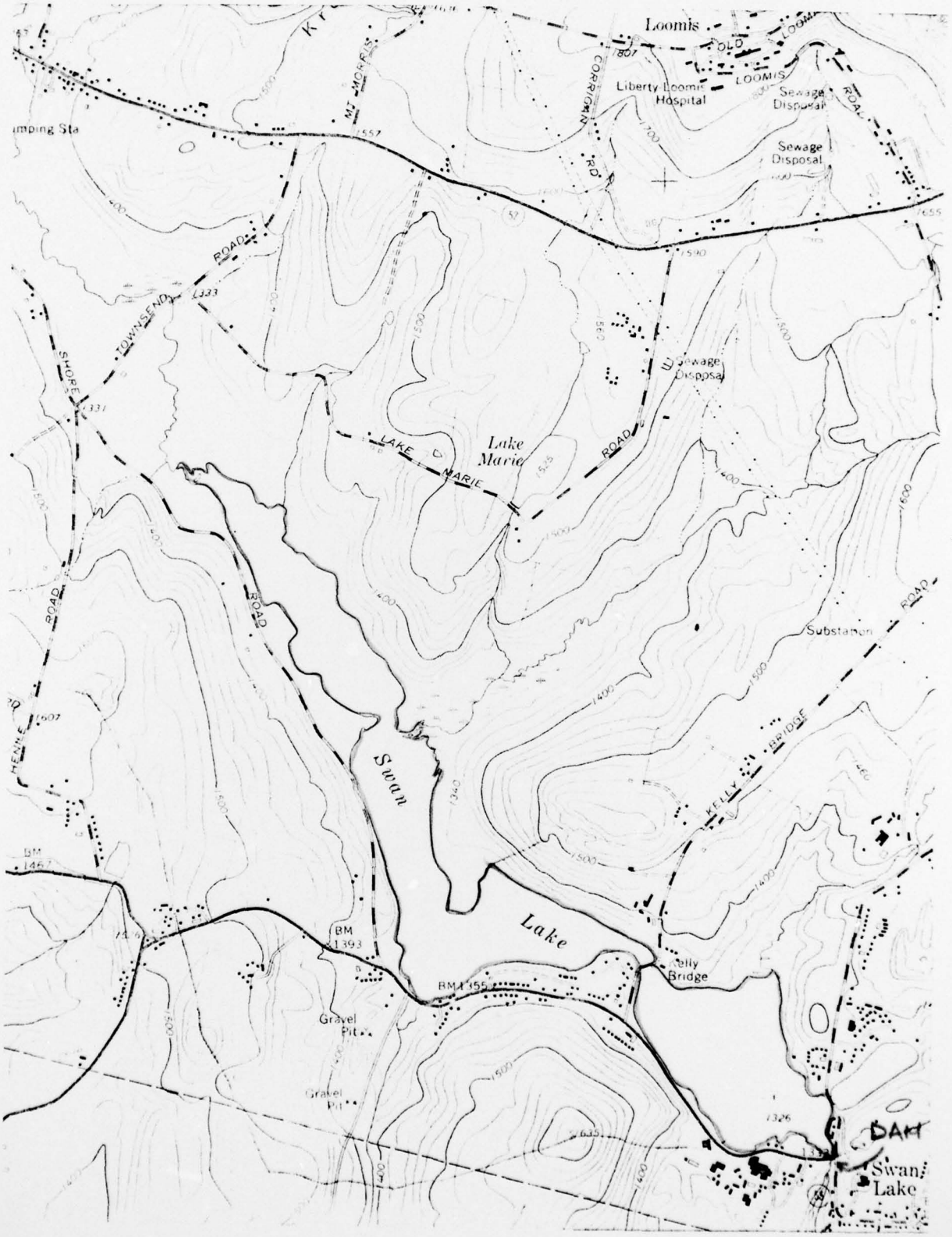
7) Cornell University Agriculture Experiment Station (compiled by M.G. Cline and R.L. Marshall), General Soil Map of New York State and Soils of New York Landscapes, Information Bulletin 119, 1977.

APPENDIX F

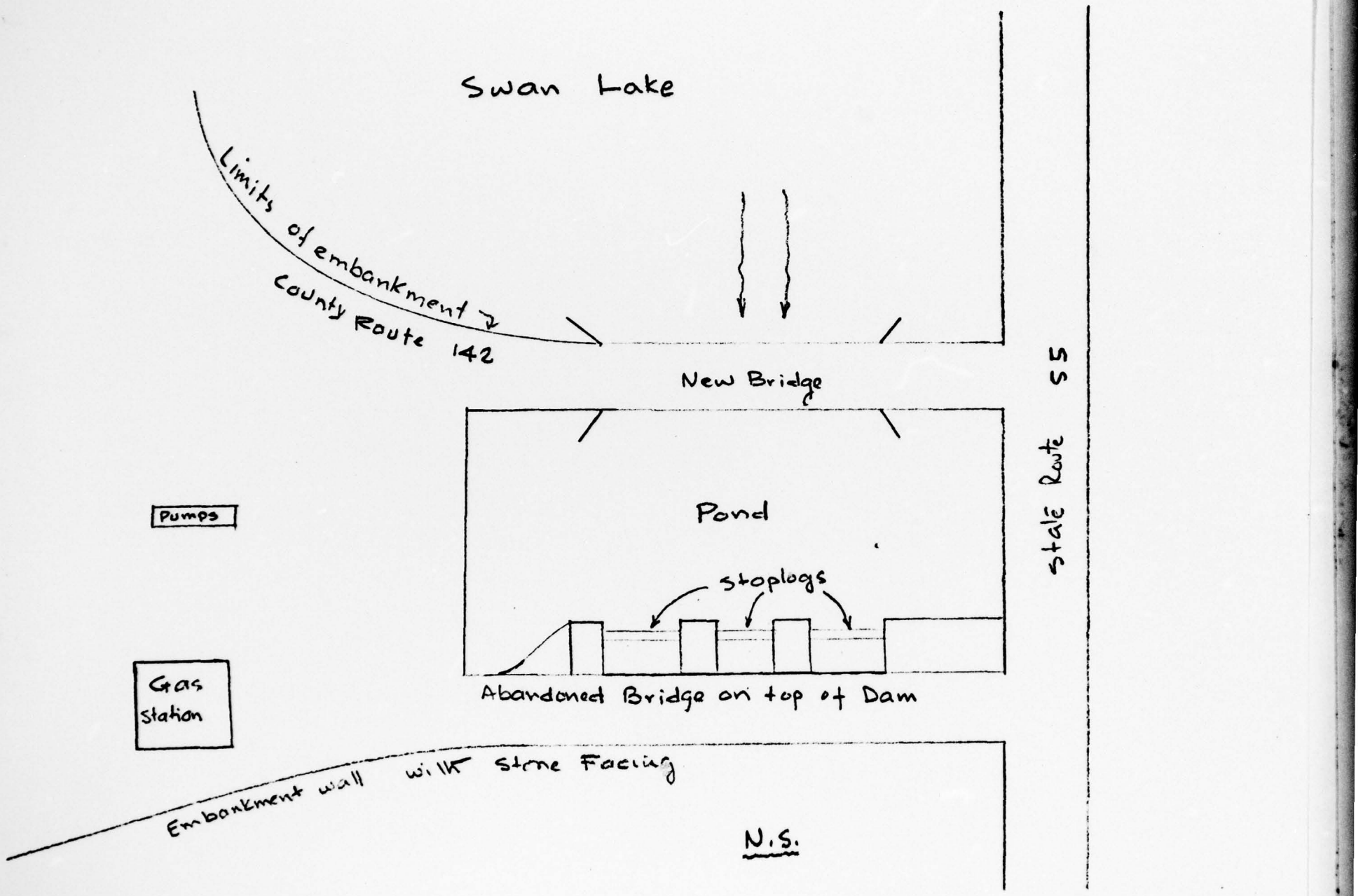
DRAWINGS



SULLIVAN COUNTY
SHOWING
STATE, COUNTY & TOWN
HIGHWAY SYSTEMS
ULSTER
To ELLENVILLE
ULSTER COUNTY
To ELLENVILLE
FALLSBURG
BETHEL
THOMPSON
MAMAKATING
FORESTBURG
HIGHLAND
LUMBERLAND
WOODBOURNE
LOCH SHELDRAKE
HURLEYVILLE
FALLSBURG
SOUTH FALLSBURG
WOODRIDGE
MOUNTAINDALE
FERNDALE
WAN LAKE
HARRIS
BUSHVILLE
KIAMESHA
THOMPSONVILLE
GLEN WILD
MONTICELLO
WHITE LAKE
KAUNEONGA LAKE
SMALLWOOD
MONGAUP VALLEY
BETHEL
MOUNT VERNON
PHILLIPSPORT
SUMMITVILLE
WANAKSINK
ROCK HILL
BRIDGEVILLE
ROSCOE GAP
BURLINGHAM
WURTSBORO
BLOOMINGBURG
To MIDDLETOWN
ORANGE
HAVEN
SQUIRREL COR'S
St Josephs Lake
MERRIEWOLD
SWINGING BRIDGE DAM
FOWLERVILLE
FORESTBURG
HARTWOOD
Wolf Reservoir
NEVERSINK RIVER
MONGAUP FALLS DAM
HIGHLAND LAKE
ELDRED
GLEN SPEY
OAKLAND VALLEY
WEST BROOKVILLE
To PORT JE
To MIDDLE
ORANGE COUNTY
Toronto Lake
Toronto Reservoir
C.R. 183A
C.R. 173A
C.R. 173
C.R. 48
C.R. 166
C.R. 163
C.R. 142
C.R. 108
C.R. 109
LEGEND



TOPOGRAPHIC MAP


Swan Lake
Limits of embankment
County Route 142
New Bridge
State Route 55
Pumps
Pond
stoplogs
Gas Station
Abandoned Bridge on top of Dam
Embankment wall with stone Facing
N.S.

Stevensville N Y
May 13th 1919

Mr Perkins

Dear Sir your inquiry of the 12th in regard to the retaining wall or dam at Swan Lake received. In reply I would say that I assisted in building the face wall on the original dam in the year 1884.
That wall was built on solid rock. The excavation was from four feet to nine feet below the surface of the ground. and filled with grout or concreet then it was layed with stone and portland Akes cement. The rock or stone was bedded in the cement. The face wall was four feet thick

Yours Respectfully
Frank N Mungeer

GUARD							DATE
INFORM.							
RECD.							
COMP.							
PP. INIT.							
FILED							
ACCT.		X					
FOR. OF							
ATD. TO							
FOR							

FORM W51. 5-12-16-2000 (16-16738) Acc. 382

(NOTICE: After filling out one of these forms as completely as possible for each dam in your district, return it at once to the Conservation Commission, Albany.)

STATE OF NEW YORK

CONSERVATION COMMISSION

ALBANY

DAM REPORT

July 8 (Date), 191...

CONSERVATION COMMISSION,

DIVISION OF WATERS.

GENTLEMEN:

I have the honor to make the following report in relation to the structure known as the Stevensville 147-279 Del Dam.

This dam is situated upon ~~the~~ a branch of the Mongaup River (Give name of stream)

in the Town of Liberty, Sullivan County,

about Five miles (State distance) from the Village or City of Liberty

~~The distance~~ (Up or down) ~~stream from the dam, to the~~ A bridge is built over the dam (Give name of nearest important stream or of a bridge)

~~is about~~ (State distance).

The dam is now owned by Mrs. Mary A. Swann, Stevensville N.Y. (Give name and address in full)

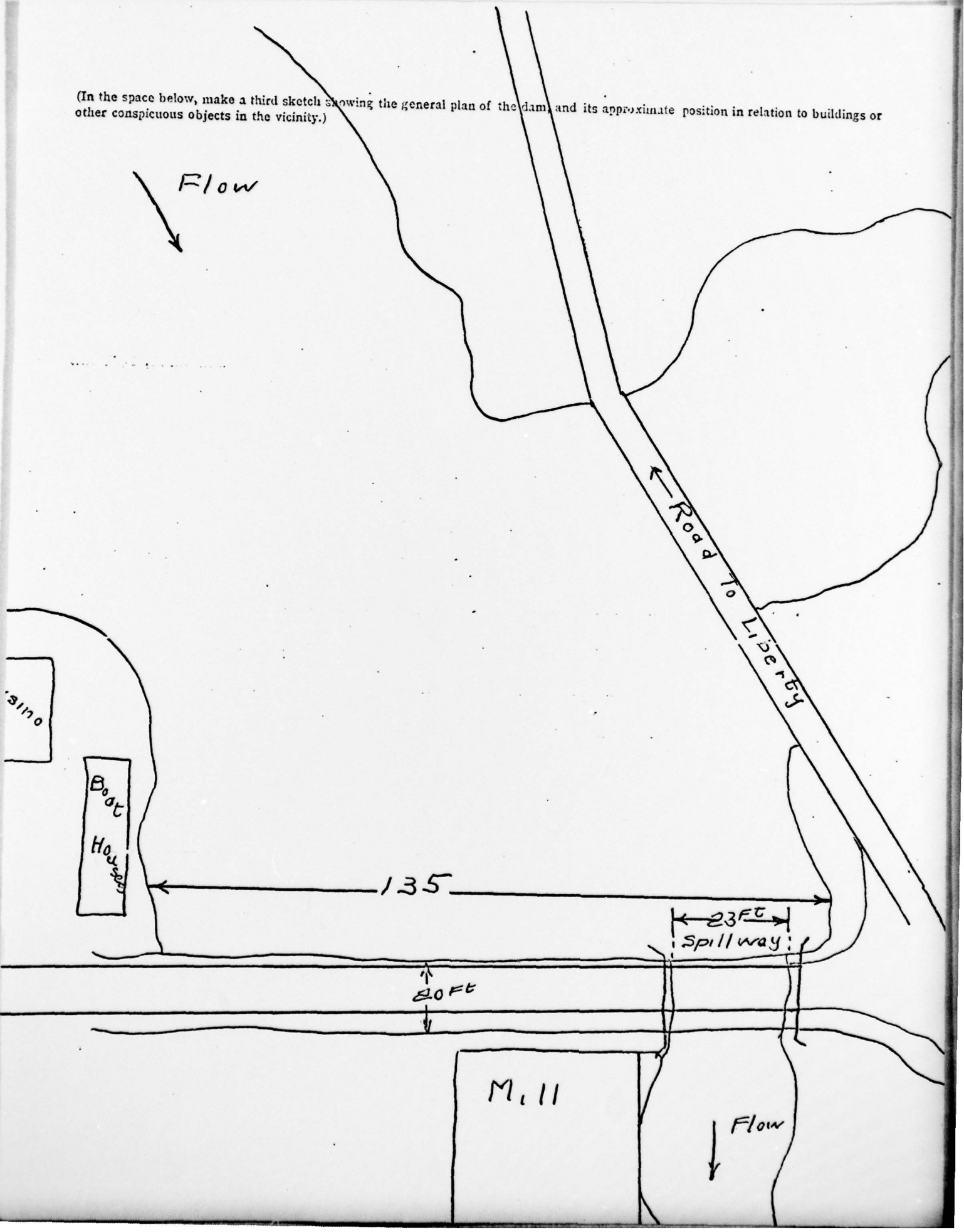
and was built in or about the year 1898, and was extensively repaired or reconstructed during the year ——.

As it now stands, the spillway portion of this dam is built of timber & masonry (State whether of masonry, concrete or timber)

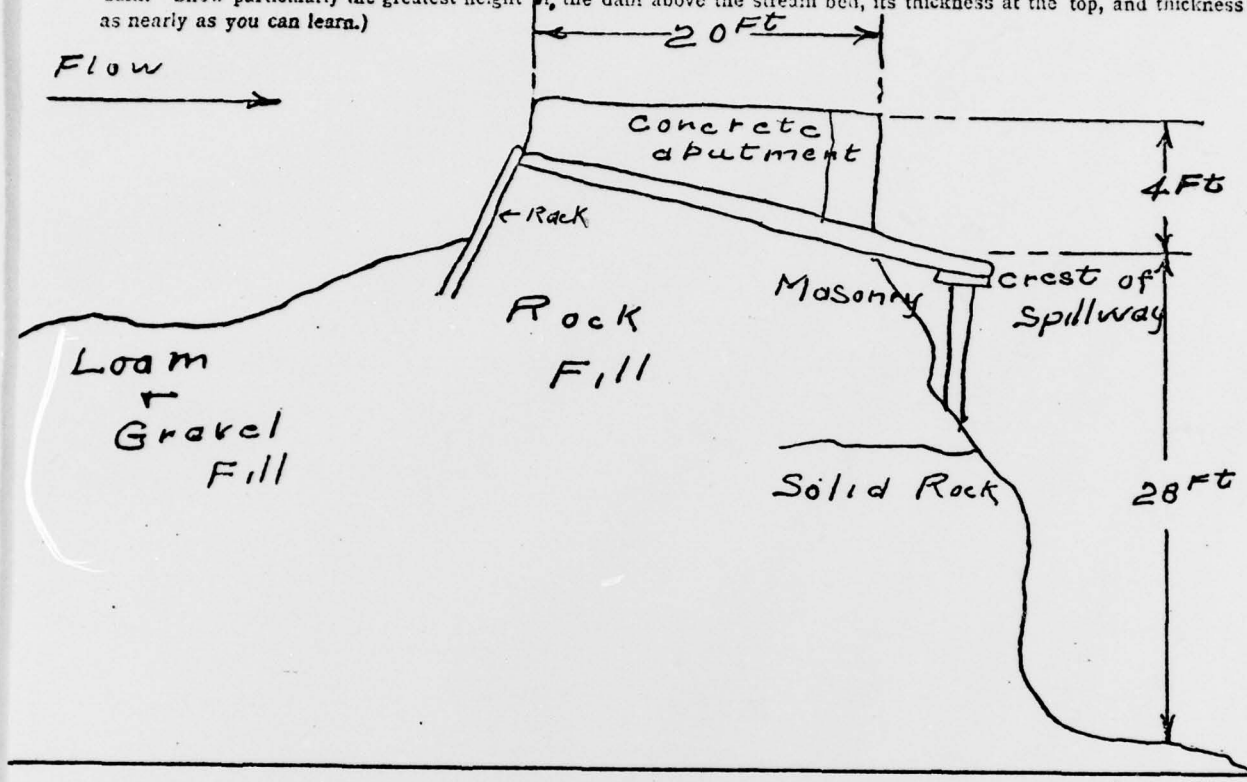
and the other portions are built of masonry with rock fill (State whether of masonry, concrete, earth or timber with or without rock fill)

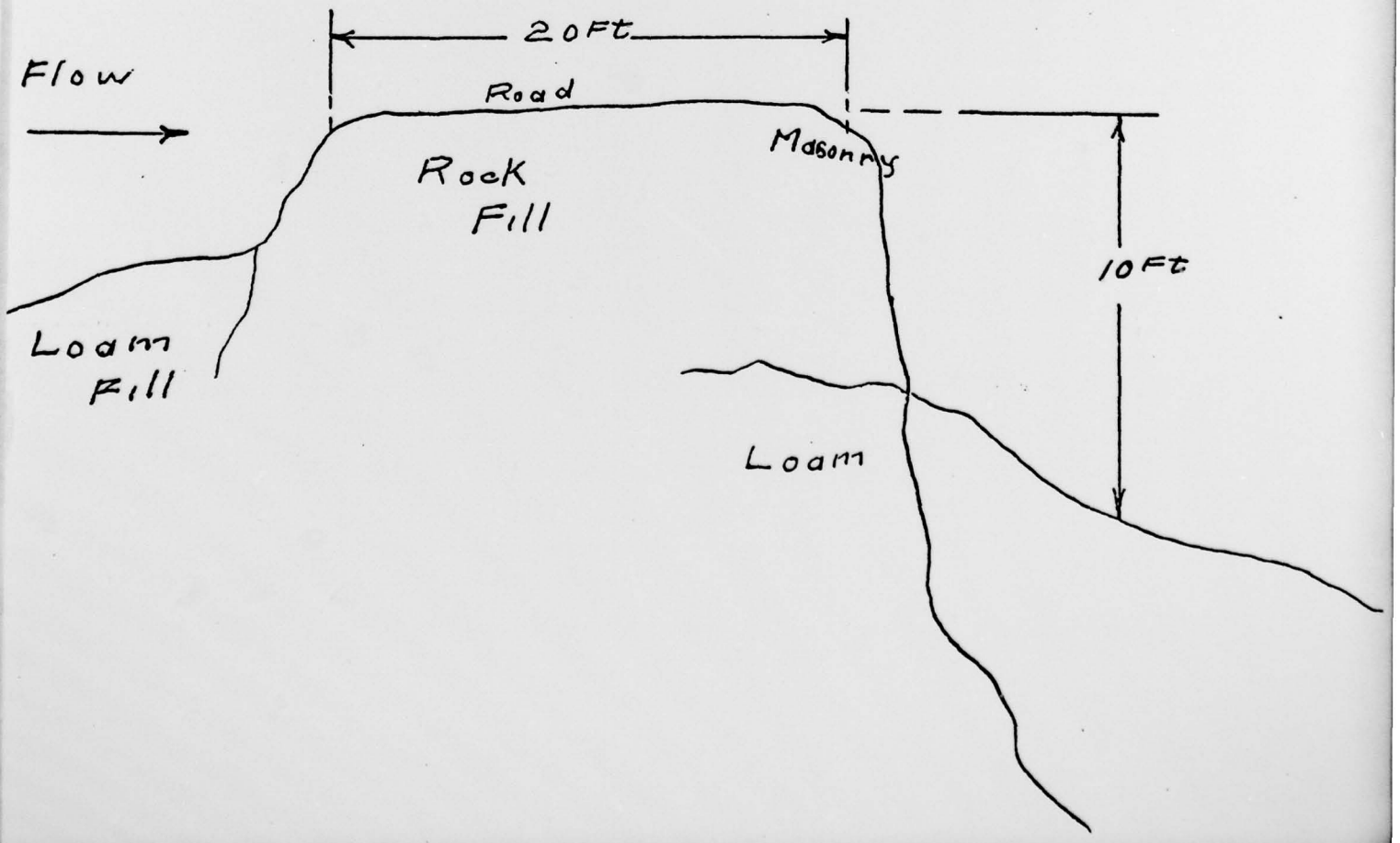
As nearly as I can learn, the character of the foundation bed under the spillway portion of the dam is solid rock and under the remaining portions such foundation bed is rock & loam.

(In the space below, make a third sketch showing the general plan of the dam, and its approximate position in relation to buildings or other conspicuous objects in the vicinity.)



(In the space below, make one sketch showing the form and dimensions of a cross section through the spillway or waste-weir of this dam and outline the abutment, and a second sketch showing the same information for a cross section through the other portion of the dam. Show particularly the greatest height of the dam above the stream bed, its thickness at the top, and thickness at the bottom, as nearly as you can learn.)





The total length of this dam is 135 feet. The spillway or waste-weir portion, is about 23 feet long, and the crest of the spillway is about 4 feet below the abutment.

The number, size and location of discharge pipes, waste pipes or gates which may be used for drawing off the water from behind the dam, are as follows: Two pipes 3½ feet diameter

At the time of this inspection the water level above the dam was 1 ft. 2 in. ~~above~~ below the crest of the spillway.

(State briefly, in the space below, whether, in your judgment, this dam is in good condition, or bad condition, describing particularly any leaks or cracks or erosions which you may have observed.)

The dam is in fair condition.
A new dam was constructed directly in back of this old one making the width 20 feet in all
On sounding this dam it found that the water was running thru the old dam and down between the old and new and coming out at the bottom
Because of the thickness, the exact place where the water came thru could not be ascertained.

The dam does not show any signs of bulging or giving way.
An old mill would be swept away and severe damage might result down the valley should the dam go out

Reported by Edwin Krauss
(Signature)

R F D. 1
(Address—Street and number, P. O. Box or R. F. D. route)

Poughkeepsie, N. Y.
(Name of place)